POSTTRAUMATIC STRESS REACTIONS IN DYADS FOLLOWING SEVERE TRAUMATIC BRAIN INJURY: FOCUS ON INTERPERSONAL PROCESSES

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ABSTRACT

Intrapersonal theories about the adjustment to traumatic stress have recently been extended to account for the evident role of interpersonal processes related to trauma and posttraumatic stress disorder (PTSD). This PhD thesis reviews the current literature on the social aspects of traumatic stress. The theoretical background furthermore proposes to take over different perspectives on the social contexts of trauma survivors, and to exhaustively investigate single components of the complex interplay between intra- and interpersonal aspects of traumatic stress. Life-threatening medical events in general, and severe traumatic brain injury (TBI) as one example, can elicit posttraumatic stress (PTS) symptoms in a subgroup of patients and their significant others. These types of potentially traumatic events provide an appropriate context to study interpersonal processes after trauma.

The three sub-studies of this cumulative PhD thesis followed two primary aims: (1) to study the impact of severe TBI on the patients' significant others, and (2) to investigate the role of one particular type of social interaction following trauma: the disclosure of trauma-related thoughts and feelings. Sub-studies I and III examined symptoms of PTS in the patients' significant others at short- and at long-term. Thereby, around half of the significant others endorsed clinically significant levels of PTS symptoms in the first weeks after the accident. However, across one year following the accident, only a small but substantial subgroup reported persistent stress reactions. Sub-studies II and III studied the association between problematic disclosure tendencies and psychological adaptation to the consequences of severe TBI in patients and their significant others. In line with previous research, both sub-studies found a substantial intrapersonal relationship between the two concepts. Moreover, Sub-study II detected an additional interpersonal association at the level of the patient-significant-other dyad.

The findings are discussed against the background of current interpersonal theories of PTSD and chronic illnesses. Implications for clinical practise are derived with regard to the treatment of patients and significant others affected by the consequences of severe TBI, and with regard to the treatment of PTSD. To guide future research on interpersonal aspects of trauma and PTSD, and the disclosure of trauma concept in particular, a multiconstruct multimethod and multiperspective approach is presented at the end of this work.

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ABBREVIATIONS

AAAM	Association for the Advancement of Automotive Medicine
AIS	Abbreviated Injury Scale
APA	American Psychiatric Association
CATS	Couple Adaptation to Traumatic Stress model
CBCT	Cognitive-behavioral Conjoint Therapy for PTSD
CBIT	Cognitive-behavioral Interpersonal Theory of PTSD
DSM	Diagnostic and Statistical Manual of Mental Disorders
DTQ	Disclosure of Trauma Questionnaire
EMS	Emergency Medical Service
GCS	Glasgow Coma Scale
GOS	Glasgow Outcome Scale
GOSE	Glasgow Outcome Scale Extended
HAIS	AIS of head region
ICU	Intensive Care Unit
IES–R	Impact of Event Scale Revised
IOM	Institute of Medicine
ISS	Injury Severity Score
LGMM	Latent Growth Mixture Model
NACA	National Advisory Committee for Aeronautics
PEBITA	Patient-relevant Endpoints after Brain Injury from Traumatic Accidents
PTE	Potentially Traumatic Event
PTS	Posttraumatic Stress
PTSD	Posttraumatic Stress Disorder
STBI[1]	Severe Traumatic Brain Injury
SSS–PTSD	Short Screening Scale for DSM-IV PTSD
TBI	Traumatic Brain Injury

[1] This Abbreviation was only used in Sub-study I.

1 BACKGROUND

1.1 Introduction

Emotionally traumatic events happen within a social context rather than in vacuum. Depending on the type of experience, the effects extend beyond the affected individuals to their spouses, peers, families, communities, and even whole societies. Currently, the social contextual characteristics of trauma, and trauma related interpersonal processes in particular, gain more and more interest in research on traumatic stress to inform theory and treatment (Charuvastra & Cloitre, 2008; Maercker & Horn, 2011; Monson, Fredman, & Dekel, 2010; Nelson Goff & Smith, 2005). This PhD thesis contributes to the growing body of literature by focussing on two interpersonal facets in relation to trauma: (1) the psychological impact of a potentially traumatic event on significant others, and (2) the way individuals affected by traumatic stress share their experience with others. It derives and empirically tests assumptions from theoretical frameworks and previous research to study these two social aspects of trauma in dyads comprising one individual who survived severe traumatic brain injury and a significant other.

Three research articles (sub-studies) constitute the central part of this cumulative PhD thesis. Two of these were published in scientific journals and one paper was ready for submission at the time of printing this thesis. The three manuscripts are provided in full length at the end of this work (see section 4, p. 53). In the following, the theoretical background will be presented describing relevant theories and empirical findings regarding the social aspects of traumatic stress in detail (see section 1.2, p. 2). Furthermore, the concept of life-threatening medical conditions as potentially traumatic events will be discussed (see section 1.3, p. 14). Thereby, to generally introduce to the trauma population focussed with this work, a brief literature review is given on the psychological sequelae of severe traumatic brain injury for patients and their significant others. Afterwards, in section 2, the objectives, main findings, and conclusions of each of the three sub-studies are briefly summarized. A detailed overall discussion follows including implications for clinical practice (see section 3, p. 34). The report concludes with considerations about future research directions based on this PhD thesis.

1.2 Interpersonal Processes related to Potentially Traumatic Events

Trauma and posttraumatic stress disorder (PTSD) has traditionally been conceptualized individual-centred with etiological and interventional theories predominantly focussing on the emotional, cognitive, behavioural, and biological changes within the individual exposed to traumatic stress (see Brewin & Holmes, 2003, and Nemeroff et al., 2006, for an overview). However, several authors have argued that traumatic events and the adaptation to trauma happen embedded within a social context (Charuvastra & Cloitre, 2008; Maercker & Horn, 2011; Monson et al., 2010; Nelson Goff & Smith, 2005). First, a large number of traumatic events involve interpersonal interaction, e.g., (sexual) violence, and these have been found to be especially pathogenic with regard to PTSD (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). Moreover, other types of traumas such as natural disasters affect whole families or communities that have to deal with subsequent traumatic stress collectively. Furthermore, even in case of a nonviolent trauma experienced by one individual, the effects of trauma and PTSD stretch far beyond the primary trauma victim, impairing interpersonal relationships as well as the wellbeing of close others, for example, spouses and family members. At the same time this social context represents one of the most important conditions to determine the adjustment of the affected individual. This section provides the theoretical background of the particular interest in studying interpersonal processes in the aftermath of trauma. It begins with a summary of empirical findings followed by the presentation of three theories about the social aspects of trauma and PTSD. Finally, as an example of trauma-specific social interaction, the concept of *disclosure of trauma* will be discussed in more detail.

1.2.1 Empirical findings on trauma related interpersonal processes

Trauma and PTSD changes how the affected individuals perceive themselves and the world around them (e.g., Ehlers & Clark, 2000; Janoff-Bulman, 1992). Most likely these changes also modify the way individuals interact with each other. On the other hand, interpersonal relationships may influence the individual's response to traumatic stress. To demonstrate that the interplay between interpersonal variables and trauma/PTSD is most likely a complex, reciprocal, or transactional one, the following review is structured in three sections. The first two parts will show how social interaction and interpersonal relationships can impact the processing of traumatic stress by either "play[ing] an exacerbating or ameliorative role in the

posttraumatic recovery process [...] protecting against or aggravating the effects of trauma" (Smith & Fisher, 2008, p. 277). The third paragraph will present findings that elicit the destructive power of trauma and PTSD on interpersonal variables.

The protective effects of social relationships

Generally, in the context of trauma and PTSD, social support can be conceptualised as the assistance and support provided by others when coping with traumatic stress (Kaniasty, 2008). Dealing with trauma, social interaction can be beneficial because it prevents or reduces exposure to traumatic stressors, helps appraising the experience in a less tremendous way, provide informational and instrumental support, e.g., access to health care services or basic supply, as well as emotional support, e.g., comforting or standing by, and it can simply help maintaining a basic feeling of being affiliated within society (Charuvastra & Cloitre, 2008; Guay, Billette, & Marchand, 2006; Kaniasty, 2008). With other words, reactions by significant others affect the trauma survivor's adjustment to traumatic stress both directly and indirectly by modifying appraisals, coping styles, and the emotional state (Joseph, Williams, & Yule, 1997; Williams and Joseph, 1999, cited in Guay et al., 2006). It is therefore not surprising that social support was among the most predictive variables identified in meta-analytic research on predictors of PTSD (Brewin, Andrews, & Valentine, 2000; Ozer, Best, Lipsey, & Weiss, 2003). It is important to notice that most studies conceptualised social support as *perceived* social support, and therefore captured the subjective appraisals of the availability or expectation of support when in need rather than the actually received support (Kaniasty, 2008). Evidence for a protective effect supports both the stress buffering hypothesis which suggests an interaction effect with social support attenuating the impact of traumatic stress, and the main effect model suggesting social support to directly enhance mental health regardless the severity of strain (Kaniasty, 2008). Furthermore, the beneficial effects seem to depend on several other variables such as the type of support provider (Laffaye, Cavella, Drescher, & Rosen, 2008), and the type of trauma (Punamaki, Komproe, Qouta, El-Masri, & de Jong, 2005; Ullman, 2007). Punamaki et al. (2005) for example, found higher levels of social support in individuals with military trauma compared to individuals with a history of childhood abuse.

Interpersonal relationships bear a risk

In their review on the "social ecology of PTSD" (p. 301), Charuvastra and Cloitre (2008) conclude that there is much more consistent evidence suggesting a positive

relationship between PTSD on one hand and negative social interactions or lack of social support on the other. Therefore, even individuals with a solid social network and thus potential sources of support, are not immune to PTSD. Considering a variety of aspects that can go wrong when providing support this is not surprising. For example, the type of support may be inadequate or provided at the wrong time. Even well-meant offers of help may be misunderstood. Furthermore, regardless the intention of others, social interactions posttrauma can be stressful and therefore even exacerbate symptoms of PTSD (Andrews, Brewin, & Rose, 2003; Pruitt & Zoellner, 2008; Ullman, 2003; Ullman & Filipas, 2001; Zoellner, Foa, & Brigidi, 1999). For example, Ullman and Filipas (2001) studied the relationship between a variety of social reactions to the disclosure of sexual assault (e.g., blaming the victim, treating the victim differently, providing support) and PTSD symptom severity in a sample of 323 women. They found that more negative social reactions were associated with more severe PTSD after controlling for demographic variables and perceived life-threat caused by the assault (Ullman & Filipas, 2001).

The destructive power of trauma and PTSD beyond the primary victims

A growing body of evidence has demonstrated that trauma and PTSD can impair the wellbeing of the primary victims' significant others (Figley, 1993; Galovski & Lyons, 2004; Monson & Taft, 2005; Monson, Taft, & Fredman, 2009; Taft, Watkins, Stafford, Street, & Monson, 2011). On one hand these studies found that trauma and PTSD were associated with a less secure attachment style (Ghafoori, Hierholzer, Howsepian, & Boardman, 2008), poorer interpersonal functioning (Allen, Rhoades, Stanley, & Markman, 2010; Taft et al., 2011), or satisfaction (Dirkzwager, Bramsen, Ader, & van der Ploeg, 2005), and with higher rates of divorce (Whisman, 1999). On the other hand, this research showed that trauma and PTSD can impact the family members' mental health. Accordingly, particularly spouses were found to experience symptoms of PTSD in relation to their relatives' traumatic experiences (Bramsen, van der Ploeg, & Twisk, 2002; Dekel & Solomon, 2006; Yehuda, Halligan, & Bierer, 2001). In addition to this special type of impairment which is sometimes termed *secondary* or *vicarious traumatisation* (Courtois, 2008), family members of PTSD patients endorsed elevated levels of general distress (Dirkzwager et al., 2005), and specific psychiatric symptoms such as depressive and anxiety symptoms (Arzi, Solomon, & Dekel, 2000).

Furthermore, trauma and PTSD can erode the previously highlighted positive effects of social support. Accordingly, chronic PTSD was found to be associated with a decline in perceived social support across time (Kaniasty & Norris, 2008; King, Taft, King, Hammond, & Stone, 2006; Laffaye et al., 2008; Lui, Glynn, & Shetty, 2009). For example, Kaniasty and Norris (2008) reported a time-dependent change of the causal direction between PTSD and social support when investigated across two years. Thereby, between six and twelve months after a natural disaster, social support lead to less PTSD; between 12 and 18 months bidirectional paths emerged, and in the final period between 18 and 24 months more severe PTSD lead to less support (Kaniasty & Norris, 2008). Decrease in social support is likely to be mediated by problems in interpersonal functioning (King et al., 2006) and PTSD-related negative attributions about the social network (Clapp & Gayle Beck, 2009).

A comment on research methodology: 'Real' interpersonal research

Only a few studies have investigated interpersonal aspects of adjustment to trauma, in fact, interpersonally, i.e., by implementing study designs that capture information from several perspectives of the affected social system (e.g., Allen et al., 2010; Bramsen et al., 2002; Kramer, Ceschi, Van der Linden, & Bodenmann, 2005; Monson, Gradus, La Bash, Griffin, & Resick, 2009; Renshaw, Rodrigues, & Jones, 2008; Smith & Fisher, 2008). Such research designs can be beneficial because they illuminate effects at the interpersonal level that might otherwise be overlooked. For example, in a study with couples affected by natural disaster, neither the wives' nor the husbands' negative world assumptions correlated with each individual's level of PTSD symptoms. However, when husbands held less benevolent beliefs about the world, the expected significant positive relationship emerged between the wives' negative beliefs and their level of distress (Monson, Gradus et al., 2009). Similarly, Renshaw et al. (2008) found that the partners' attributions of the trauma victims' experiences can be relevant to the couple's relationship adjustment. In their study, the level of combat exposure estimated by the soldiers' wives moderated the correlation of the wives' relationship satisfaction and the soldiers' PTSD symptom severity. This association was only found when wives erroneously reported that their husbands had experienced low levels of combat exposure (Renshaw et al., 2008). These briefly reviewed findings from *real* interpersonal research demonstrate that the investigation of social aspects of trauma and PTSD calls for more complex study

designs than simply focussing on the traumatised individual and on how he or she perceives what is going on in the surrounding social world.

In sum, the empirical findings reviewed in this section highlight the close connection between trauma and social phenomena pointing to the following conclusions: Interpersonal processes in relation to trauma are multifaceted involving mutual influences among the trauma survivor and his or her social environment as well as including both positive and negative effects on mental health and interpersonal relationships. This observation leads to two important claims for further research: First, theories of PTSD should comprehensively cover the social aspects of trauma and trauma recovery in addition to the intrapersonal processes traditionally focussed. Second, because the interplay between social phenomena and trauma is complex, only small parts of the whole picture can be examined at a time. Such research should focus on interpersonal variables that are more trauma specific compared to the broad concept of social support. These should be studied in depth, ideally by employing a prospective longitudinal design and by capturing multiple perspectives of the phenomena concerned. With the following two sections literature is summarized that points into the direction of the two postulated claims.

1.2.2 Interpersonal theories of PTSD

This section presents three theories of PTSD that particularly cover the central influential role of the social context: the couple adaptation to traumatic stress model (Nelson Goff & Smith, 2005), the cognitive-behavioral interpersonal theory of PTSD (Monson et al., 2010), and the socio-interpersonal model of PTSD (Maercker & Horn, 2011).

The Couple Adaptation to Traumatic Stress Model

From an early point, marriage and family therapy has focussed on treating families affected by traumatic stress and its specific demands on family systems (e.g., Figley, 1988; Johnson & Williams-Keeler, 1998; Riggs, Monson, Glynn, & Canterino, 2009). Inspired by the clinical practice of couple therapy Nelson Goff and Smith (2005) proposed the couple adaptation to traumatic stress model (CATS). Within one framework the CATS model captures the effects of traumatic stress on the primary trauma survivor and on the spouse as well as the interpersonal effects proceeding at the level of the couple dyad. The CATS model comprises three components: (1) the two *individual levels of functioning* of the traumatized individual and of the spouse; these levels are described to be mutually influential, (2) *predisposing factors and*

resources of both the two individuals and the couple dyad, and (3) the *interpersonal functioning* of the couple. The CATS model assumes that the couple's adaptation to traumatic stress is determined by the circular interaction between these three components. To further explain how traumatic stress operates systemically within the couple, the authors list a number of potential mechanisms. For example, the secondary trauma victim may experience stress symptoms him- or herself because the PTSD symptoms of the primary trauma victim represent a chronic stressor, or because they internalize both the traumatic experience and the subsequent psychopathology. Further possible transmission mechanisms concern trauma-specific projection and attachment processes. However, as stated by the authors, little empirical support has yet been gathered for any of these explanations (Nelson Goff & Smith, 2005).

The Cognitive-Behavioral Interpersonal Theory of PTSD

The initial point of the interpersonal theory of PTSD by Monson and colleagues (2010) is the reciprocal association between PTSD and intimate relationship problems with PTSD contributing to interpersonal problems, and the couple's distress, in turn, reinforcing PTSD (Fredman et al., 2011; Monson, Fredman, & Adair, 2008; Monson et al., 2011; see section 1.2.1). In order to enhance the efficacy of individual PTSD treatment, the authors developed the cognitive-behavioral conjoint therapy for PTSD (CBCT, Monson et al., 2008; Monson, Schnurr, Stevens, & Guthrie, 2004). CBCT aims to foster recovery from PTSD and to simultaneously improve the intimate relationship functioning of the couple involved. To base CBCT on a theoretical background, Monson et al. (2010) proposed the cognitive-behavioral interpersonal theory of PTSD (CBIT). The CBIT expands the focus from individual functioning explicitly to the recursive link between PTSD and interpersonal relationship functioning. Accordingly, both the two individuals involved and their relationship are influenced by the dynamic interactions of the cognitive (e.g., threat appraisal, trust), behavioural (e.g., aggression, communication style), and affective variables (e.g., anger, sadness) within and between them. At the level of the dyad these recursive associations shape important interpersonal characteristics of the relationship quality, e.g., intimacy, relationship satisfaction, and cohesion. Furthermore, the CBIT proposes avoidance and poor communication to be central mediators between PTSD symptoms and interpersonal functioning (Monson et al., 2008; Monson, Taft et al., 2009). For example, it is assumed that the partners of

PTSD patients accommodate the patients' avoidance symptoms, and in this way reinforce the disorder (Fredman et al., 2011).

In addition to promising preliminary findings regarding the efficacy of CBCT in decreasing psychopathology and mutually improving relationship adjustment (Monson et al., 2011; Monson et al., 2004), the work by Monson and colleagues provides a profound framework to explain the interplay between PTSD and interpersonal functioning based on recent empirical findings. The authors state that research should also consider further aspects of both trauma- and intimacy-associated biological factors as well as the socio-cultural context to gain a complete biopsychosocial understanding of PTSD (Monson et al., 2010).

The Socio-Interpersonal Model of PTSD

Whereas the CATS model and the CBIT primarily focus on couples affected by traumatic stress, Maercker and Horn (2011) proposed a perspective on PTSD that comprehends interactional and contextual aspects of PTSD at different levels of social proximity. The socio-interpersonal model of PTSD can be seen as a completion of PTSD theory, in addition to the widely acknowledged classical etiological models on traumatic stress (Brewin & Holmes, 2003, for an overview). The model conceptualises three levels of social contexts in which trauma related interpersonal processes proceed. The levels are permeable and interlaced, with one level nested within the next distant one: (1) the level of the *individual* covers the intrapersonal perspective on PTSD as conceptualised by traditional PTSD models. Moreover, it includes the traumatised individual's perception of and its influence on the social environment. This concerns social affective responses to trauma exposure, such as feelings of shame, guilt, anger, and revenge. (2) The level of *close social relationships* captures PTSD-relevant aspects of the interaction with significant others, e.g., intimate partners, family members, and peers. These can either be positive (e.g., exchange of social support) or negative social interaction (e.g. blaming the victim), or represent the consequences of more chronic negative interaction patterns (e.g., loss of empathy). (3) Finally, the more *distant social contexts* are included into the model as a third level that is shaped by individual and collective trauma responses which, in turn, transform the proximal social world. Trauma relevant societal concepts are located at this level (e.g., the *social acknowledgement* of the trauma survivor; Fontana & Rosenheck, 1994; Johnson et al., 1997; Maercker & Müller, 2004).

The model proposes that the outcome after exposure to traumatic stress is determined by the processes on each of the three levels as well as by their interplay. The resulting reactions can each be allocated to one of the three levels. Thereby, at level one, responses to trauma manifest in terms of trauma related psychopathology and impaired wellbeing. The quantity and quality of close social relationships is determined on level two, and the degree of social integration within society and societal segregation respectively on level three. The authors emphasize that especially these second and third levels' outcomes are relevant factors in the development and maintenance of PTSD (Maercker & Horn, 2011). In sum, the socio-interpersonal model of PTSD constitutes a comprehensive approach to structure theoretical assumptions and findings on interpersonal processes occurring post trauma as well as their complex interplay with PTSD. It goes beyond the CATS and the CBIT models because it captures more distant social contexts in addition to the level of the (couple) dyad. Although it does not propose any hypotheses on the underlying mechanisms, the model provides a fruitful basis for adopting an interpersonal perspective in PTSD research and treatment.

1.2.3 Focus on trauma-specific social interaction: the disclosure of trauma

The second claim, in addition to base research on overarching theoretical frameworks, was to focus on social phenomena that are trauma-specific, and to study these in depth. This PhD thesis takes a closer look at one particular trauma related social interaction: the disclosure of trauma. Disclosure of trauma can be conceptualised as the tendency to openly talk about a traumatic experience, about subsequent psychological distress, and about trauma related thoughts and feelings (Müller & Maercker, 2002). In the treatment of PTSD, talking about trauma and its consequences is almost inevitable and perceived as a major component of treatment efficacy (e.g., Bisson & Andrew, 2007; Bisson et al., 2007). But even outside the therapy setting, when encountered with an emotionally relevant experience people naturally engage in social sharing at least in 90% of the cases (Pennebaker, Zech, & Rimé, 2001; Rimé, Philippot, Boca, & Mesquita, 1992). However, trouble shared is not trouble halved in every case: Like it turned out with regard to other interpersonal processes following trauma (see section 1.2.12), disclosure of trauma is multifaceted and may not be simply linked to better outcomes. This section reviews the main findings and theoretical assumptions concerning the link between trauma disclosure and PTSD.

The writing paradigm

A long tradition of research has focussed on the beneficial effects of experimentally induced disclosure on health (Frattaroli, 2006; Pennebaker et al., 2001). For example, in their first study employing the *writing paradigm*, Pennebaker and Beall (1986) randomly assigned 46 healthy college students to four conditions of repeated writing sessions. Three groups of participants were instructed to write about a highly negative experience by either providing the facts, focussing on emotions, or both, whereas the control group wrote about an emotionally neutral topic. Results revealed that the assignment to the condition of writing both about emotions and facts was associated with less frequent illness-related physician visits in the following six weeks. Since this first study on experimentally induced disclosure, the number of studies has enormously grown, expanding the focus to individuals with somatic or psychological complaints, and employing different modalities of disclosure. A recent meta-analysis on 146 experimental disclosure studies, conducted between 1996 and 2004, revealed an overall significant positive effect of r = .075 with respect to a variety of somatic and psychological health outcomes, such as immune functioning, health care service utilization, subjective wellbeing, psychological distress and psychopathology (Frattaroli, 2006).

A number of theories have been proposed to explain the health promoting effects of experimentally induced disclosure. As part of a general psychosomatic theory of inhibition, Pennebaker and Susman (1988) originally assumed that the non-disclosure of thoughts, feelings, and behaviours would cause physiological work and chronic rumination which would cumulate in psychosomatic illness. On the contrary, sharing of emotional relevant contents would relieve the strain of inhibition, and thus promote wellbeing. Although there is some evidence for the association between non-disclosure of traumatic experiences and poorer health parameters (Davidson & Moss, 2008; Ruggiero et al., 2004; Ullman, 2003), the proposed mechanism of disinhibition has not been substantially supported by experimental disclosure research (Frattaroli, 2006). Pennebaker (1993) developed the disclosure theory further and suggested that writing about stressful events is beneficial only if one gains insight about what happened, reorganizes the trauma memory, and integrates it into one's biography. This assumption gained support from studies that linguistically analyzed the content of trauma disclosure reports (Hoyt & Pasupathi, 2008; Pennebaker, 1993; Pennebaker & Graybeal, 2001). This cognitive-processing theory

is also in line with currently recognized etiological models of PTSD suggesting that repeated recall of the traumatic event can improve cognitive access and can complement the content of the otherwise fragmented trauma memory (Ehlers & Clark, 2000; Foa & Kozak, 1986; Horowitz, 1986). In addition, the process of re-structuring also allows correcting trauma-related erroneous assumptions about one-self and the world (Ehlers & Clark, 2000).

Furthermore, the findings can be explained by exposure theory suggesting that repeated confrontation with adverse thoughts and feelings via writing leads to its extinction (Bootzin, 1997; Kloss & Lisman, 2002). The exposure explanation holds most empirical support, e.g., by a clear effect of the disclosure dose suggesting experimental disclosure to be effective when employed at least in three sessions compromising a minimum of fifteen minutes of writing (Frattaroli, 2006). Here, the parallel to therapy can be drawn again, as exposure-based interventions are highly effective and particularly recommended for the treatment of PTSD (Institute of Medicine, IOM, 2008; McLean & Foa, 2011). Another theoretical explanation assumes that experimental disclosure can inspire participants to further disclosure activity outside the lab and to enhance their social relationships (Pennebaker & Graybeal, 2001). Furthermore, this theory of social integration argues that disclosure generates social support and positive interpersonal activity which, in turn, would promote health. Despite the remaining lack of full understanding on how experimental induced disclosure exhibits a positive effect on health—provided that some preconditions are met—its efficacy remains unquestioned as reflected by the small, but substantial, overall effect size found by Frattaroli's meta-analysis (2006).

Real-life disclosure of trauma

Purves, Philip, and Erwin (2004) as well as Burke and Bradley (2006) criticised that studies on experimentally induced disclosure lack ecological validity because participants disclose to an anonymous audience. Talking about traumatic experiences, however, is a communicative process that involves at least two individuals. Therefore, to simply transfer the experimental findings to the world outside the lab would fall too short. Several authors have focussed on different aspects of the disclosure of trauma as it occurs naturally, in real life (Bedard-Gilligan, Jaeger, Echiverri-Cohen, & Zoellner, 2011; Belsher, Ruzek, Bongar, & Cordova, 2011; Bolton, Glenn, Orsillo, Roemer, & Litz, 2003; Jacques-Tiura, Tkatch, Abbey, & Wegner, 2010; Lepore, Fernandez-Berrocal, Ragan, & Ramos,

2004; Lepore, Silver, Wortman, & Wayment, 1996; Ullman, 2003; Ullman & Filipas, 2001). Thereby, findings on the potentially health promoting effects of trauma disclosure were rather mixed. Reviewing the literature on disclosure of childhood sexual abuse, Ullman (2003) concluded that non-disclosure might be harmful especially if there is a strong wish to talk about what happened, but disclosure itself does not lead to better outcomes per se. The consequences rather depend on a number of other factors which might lie beyond the control of the person disclosing. Furthermore, Ullman (2008) stated that talking about highly aversive experiences bears the risk of compromising and exposing oneself to potentially negative judgements by the recipients. Accordingly, several studies have demonstrated that the effects of disclosure on psychological wellbeing depend on the reactions by others (e.g., Lepore et al., 1996; Ullman, 2003). Thereby, beneficial effects of disclosure were found when disclosure recipients challenged the discloser's report (Lepore et al., 2004), or when the reactions were perceived as being positive (Bolton et al., 2003). A comparatively larger body of research showed that perceived negative reactions were consistently linked to more severe distress in the discloser (Belsher et al., 2011; Jacques-Tiura et al., 2010; Ullman, 2003; Ullman & Filipas, 2001). Furthermore, the context of disclosure might be relevant, e.g., the type of person one discloses to (Bolton et al., 2003). Moreover, when individuals exercise control on the initiation and the depth of trauma disclosure, the effect may be more beneficial (Ullman, 2003). Because most studies on the role of social reactions to disclosure were conducted with samples of sexually assaulted individuals (e.g., Jacques-Tiura et al., 2010; Ullman, 2003), it remains open whether less stigmatizing traumas evoke similar effects. With regard to the underlying mechanisms of the link to more severe PTSD, negative social reactions to trauma disclosure can either prevent the suggested beneficial processes involved in trauma disclosure (e.g. habituation, structuring the trauma memory, correcting dysfunctional cognitions, mobilizing social support; see the description on page 10), and/or directly impact the individual's wellbeing in a negative way (see the description on page 3).

Dysfunctional disclosure of trauma

The findings reviewed above indicate that—like other interpersonal processes after trauma—disclosure of trauma is a complex social phenomenon. For this reason, Müller and Maercker (2002) proposed a multidimensional conceptualisation of trauma disclosure that includes textual aspects of disclosures (e.g., the level of

detail), intra- and interpersonal reasons for (non-)disclosure, the affective involvement when disclosing, and cognitions about these reactions. To capture these facets of trauma communication the authors developed and validated a self-report measure (Müller, Beauducel, Raschka, & Maercker, 2000; see section 2.1.2, p. 25). In sum, the questionnaire assesses self-reports on *problematic* or *dysfunctional* disclosure tendencies that were found among former political prisoners of the German Democratic Republic (Maercker & Müller, 2004; Müller et al., 2000), victims of violent crime in Germany and China (Müller & Maercker, 2006; Mueller, Moergeli, & Maercker, 2008; Mueller, Orth, Wang, & Maercker, 2009), refugees from Chechnya (Maercker, Povilonyte, Lianova, & Pohlmann, 2009), and Swiss citizens of older age (Müller, Forstmeier, Wagner, & Maercker, 2011). Moreover, the cited studies reported significant associations of these disclosure tendencies with more severe PTSD symptoms. Thereby, dysfunctional disclosure tendencies explained additional portions of variance in symptom severity above and beyond established predictors of PTSD (Müller & Maercker, 2006; Mueller et al., 2009). Furthermore, they mediated the association between low perceived social acknowledgement as a trauma survivor and stress response (Maercker, Mohiyeddini et al., 2008; Müller et al., 2011). Maercker and Horn (2011) assumed that the extent of self-reported problematic disclosure tendencies would determine actual disclosure behaviours and therefore influence the social reality of trauma survivors. With regard to the socio-interpersonal model of PTSD the authors therefore locate trauma disclosure at the second level, next to other interpersonal and social phenomena, such as social support and compassion fatigue.

Self-disclosure

One last aspect of disclosure should be discussed here. Whereas the above mentioned conceptualisations of disclosure focussed on the way trauma survivors talk about their traumatic experience and related thoughts and feelings, some research has investigated broader aspects of openness. Self-disclosure or emotional sharing is the individual's general tendency to talk about own emotions or to disclose emotionally relevant experiences. Self-disclosure has been linked to interpersonal emotion regulation (Rimé, 2007; Rimé, 2009) and social relationship quality (Laurenceau, Barrett, & Rovine, 2005; Manne & Badr, 2008; Manne & Badr, 2010; Solomon, Dekel, & Zerach, 2008). For example, self-disclosure mediated the relationship between PTSD and marital intimacy in a sample of Israeli former prisoners of war

(Solomon et al., 2008). Despite the conceptual differences, in the context of trauma and PTSD, both disclosure of trauma and more general self-disclosure can be quite proximal characteristics of interactions in close social relationships.

Conclusions on disclosure research

Interestingly, although some conceptualisations allude that disclosure of trauma is, at least to some extent, an interpersonal phenomenon (Müller & Maercker, 2002; Purves & Erwin, 2004; Ullman, 2008), no study has yet examined it beyond the individual's perspective. Nevertheless, researchers claimed to investigate both the trauma survivor's disclosure tendencies and the recipient's view simultaneously (Müller & Maercker, 2006), and therefore to employ what was termed *real* interpersonal research (see page 5). This PhD project tries to fill this gab by studying dysfunctional disclosure tendencies in dyads of one individual who sustained severe traumatic brain injury and a significant other.

1.3 Life-Threatening Medical Conditions as Potentially Traumatic Events

Life-threatening medical conditions provide a useful context to study social processes, such as trauma disclosure, with an interpersonal approach because they affect both the patient and his or her social world. To introduce to the population studied in this PhD study, the following sections will describe the potentially traumatising impact of medical conditions in general, and of severe traumatic brain injury in particular, on patients and their significant others. Finally, the theoretical background concludes with the description of two interpersonal theories on psychological distress in relation to medical trauma that particularly emphasize the important role of interpersonal communication. Furthermore, these frameworks propose assumptions about the mechanisms between illness-related stress, social interaction, and psychopathology as well as relationship quality.

1.3.1 Posttraumatic stress disorder following medical trauma

Since the first description of PTSD in the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-III) of the American Psychiatric Association (APA, 1980), determining traumatic stressors which by definition are etiologically related to the disorder, pose a particular difficulty in defining PTSD. This debate is reflected in repeated revisions of the stressor criterion in DSM. For example, the DSM-IV-TR currently in force requires—in addition to the presence of a catastrophic event—that "the person's response [to the event] involved intense fear,

helplessness, or horror" (DSM-IV-TR, APA, 2000). However, because of lack of evidence for the usefulness of this *subjective* trauma criterion it will be omitted in the proposed fifth revision of the DSM (APA, 2011; Friedman, Resick, Bryant, & Brewin, 2011). What experiences qualify as traumatic events and which do not? One crucial peculiarity is that by far not all individuals who experience traumas develop mental health problems, and different types of traumas were found to be associated with different relative risks for PTSD (Bonanno, 2004; Breslau et al., 1998; Kessler, et al., 1995; Maercker, Forstmeier, Wagner, Glaesmer, & Braehler, 2008; Perkonigg, Kessler, Storz, & Wittchen, 2000). Given this high variability in individual responses Bonanno, Westphal, and Mancini (2011) with reference to Norris (1992) denote the term *trauma* to be a misnomer that should be replaced by the term *potentially traumatic event* (PTE). In the following this term will be adopted.

Since the forth revision of the DSM the trauma definition explicitly includes life threatening illnesses (DSM-IV, APA, 1994). Whereas a great deal of studies on stress response after civilian traumas have focussed on individuals suffering from traumatic physical injury (Bryant et al., 2010; O'Donnell, Bryant, Creamer, & Carty, 2008; O'Donnell, Creamer, Bryant, Schnyder, & Shalev, 2003), also a broader range of medical conditions, i.e. being diagnosed with severe illness, surviving life-threatening medical events or undergoing aggressive treatment, have been discussed as potentially traumatic events (Buckley, Green, & Schnurr, 2004; Köllner, 2009; Krauseneck, Rothenhausler, Mundy & Baum, 2004; Schelling, & Kapfhammer, 2005; Tedstone & Tarrier, 2003). For example, posttraumatic stress syndromes have been studied in relation to human immunodeficiency virus (Theuninck, Lake, & Gibson, 2010), cancer (French-Rosas, Moye, & Naik, 2011; Kangas, Henry, & Bryant, 2002), cardiovascular disease (Castilla & Vázquez, 2011; Doerfler & Paraskos, 2011), chronic pain (Asmundson & Katz, 2009), and intensive care treatment (Davydow, Gifford, Desai, Needham, & Bienvenu, 2008; Griffiths, Fortune, Barber, & Young, 2007; Rattray & Hull, 2008). Overall, Krauseneck et al. (2005) estimates the rate of PTSD in relation to medical conditions to be five to ten percent. In addition to general functional impairment (e.g., Westphal et al., 2011), trauma and PTSD are associated with impaired health conditions (e.g., Friedman & McEwan, 2004). Moreover, PTSD is likely to aggravate physical illness (Köllner, 2009; Tedstone & Tarrier, 2003). For example, PTSD and chronic pain were found

to mutually maintain each other (Jenewein, Wittmann, Moergeli, Creutzig, & Schnyder, 2009; Liedl et al., 2010; Sharp & Harvey, 2001).

Predictors of posttraumatic stress following medical trauma

Mostly, risk factors of PTSD in relation to medical conditions are the same like those found to be associated with the development or maintenance of PTSD following other types of PTE (Brewin et al., 2000; Ozer et al., 2003). These can be classified as (1) pre-traumatic characteristics such as prior history of trauma or psychopathology, (2) peri-traumatic variables such as fear of death, and (3) post-traumatic factors such as poor social support and exposure to further stressful events. With regard to demographic characteristics such as female gender, younger age, and low socioeconomic as well as educational status, findings were mixed with only some studies reporting incremental validity in predicting PTSD following medical trauma (Davydow et al., 2008; Tedstone & Tarrier, 2003). In line with findings from general trauma research (Birmes et al., 2003; Brewin, Andrews, Rose, & Kirk, 1999; Harvey & Bryant, 2000; Ozer et al., 2003; Wu & Cheung, 2006), high levels of distress at an early time point after exposure to PTE, e.g., symptoms of acute stress disorder, are a strong marker for subsequent severity of PTSD symptoms following medical PTE (Bryant & Harvey, 1998; Kangas et al., 2002; Köllner, 2009; Norman et al., 2011; O'Donnell et al., 2008). Interestingly, general measures of illness severity were almost consistently found to be a rather weak predictor of PTSD (Davydow et al., 2008; O'Donnell et al., 2008; Tedstone & Tarrier, 2003). However, in addition to the established predictors of PTSD, certain characteristics of life-threatening medical conditions seem to be particularly important, e.g., ongoing or progressive physical impairment and aversive treatment which itself can be potentially traumatic to the individual affected (Kangas et al., 2002).

The course of PTS symptoms following medical trauma

PTSD can be a chronic condition persisting even for very long time (e.g., Arnberg, Rydelius, & Lundin, 2011; Boe, Holgersen, & Holen, 2011; Koenen, Stellman, Sommer, & Stellman, 2008; Solomon & Mikulincer, 2006; Zlotnick et al., 2004). Only a few studies report longitudinal data on posttraumatic stress reactions after medical PTE. Following traumatic injury, this research consistently reports a significant decrease of mean posttraumatic stress (PTS) symptoms or rates of PTSD across time (Castilla & Vázquez, 2011; Norman et al., 2011; O'Donnell et al., 2008; Schnyder, Moergeli, Klaghofer, & Buddeberg, 2001). This is in line with

epidemiological findings from psychotraumatology research in general (Kessler et al., 1995; Peleg & Shalev, 2006). Regarding other types of medical traumas, some studies identified different trajectories (Goncalves, Jayson, & Tarrier, 2011; von Kanel, Baumert, Kolb, Cho, & Ladwig, 2011). For example, Goncalves et al. (2011) followed up a sample of 111 women newly diagnosed with ovarian cancer from the beginning of chemo therapy until three months after the end of treatment. They found one large proportion of the sample that did not express PTSD at any measurement point, one group with chronic PTSD, and a sizable group with a fluctuating status of diagnosis. Again, this variability in trajectories might be attributable to progression characteristics specific to the medical condition investigated (Köllner, 2009). Therefore, it seems to be important to account for potential additional stressors that can occur in relation to physical illness, and that might influence the maintenance of PTSD symptoms, too.

Despite the strong variability of psychological outcomes after potentially traumatic medical conditions, research is consistent in finding at least a small subgroup of individuals that are at risk of suffering from severe PTS at longer term (e.g., deRoon-Cassini, Mancini, Rusch, & Bonanno, 2010; Ginzburg & Ein-Dor, 2011; Hepp et al., 2008; O'Donnell et al., 2008; Sveen, Ekselius, Gerdin, & Willebrand, 2011). There has been an enormous advancement in statistical methodology regarding the analysis of longitudinal data enabling researchers to identify different subgroups within a sample with distinct symptom trajectories and to test predictor models (Curran & Hussong, 2003; Jung & Wickrama, 2008; Muthén, 2004). Applying this method of latent growth mixture modelling, deRoon-Cassini et al. (2010) found 22% of a sample of 330 injured trauma survivors to suffer from PTSD chronically across the first six months after injury, whereas 13% recovered, another six percent showed a delayed onset pattern, and the largest group of 59% was never affected by PTS symptoms.

1.3.2 The significant other's mental health following medical trauma

Life-threatening illness has also been investigated as a potentially traumatic event when experienced in a significant other. For example, parents of children affected by chronic illness (Cabizuca, Marques-Portella, Mendlowicz, Coutinho, & Figueira, 2009), severe traumatic injury (Landolt, Vollrath, Ribi, Gnehm, & Sennhauser, 2003), ICU treatment (Bronner et al., 2011), and severe burns (Hall et al., 2006) were found to bear a certain risk. Furthermore, elevated symptom levels of PTS and rates

of PTSD were reported in other relative samples following a variety of critical medical conditions, such as ICU treatment (Anderson, Arnold, Angus, & Bryce, 2008; McAdam & Puntillo, 2009), heart transplantation (Bunzel, Laederach-Hofmann, Wieselthaler, Roethy, & Wolner, 2007; Dew et al., 2004), subarachnoid hemorrhage (Noble & Schenk, 2008), and myocardial infarction (Senol-Durak & Ayvasik, 2010)[2]. Significant others are often required to take on an active role in the patient's treatment process. Therefore, from a clinical perspective, it seems important to additionally pay attention to their mental health condition and possible impairments in functioning. Moreover, from a research view, life-threatening illness provides an adequate basis to study interpersonal processes in trauma recovery because it impacts both the patient and his/or social environment in a potentially traumatic way.

1.3.3 Severe traumatic brain injury as a potentially traumatic event

Severe traumatic brain injury is one example of a life-threatening medical condition that can be conceived as a PTE for both the affected patients and their significant others. In the following section a short description of the consequences of traumatic brain injury for the individuals affected as well as their significant others will be given.

Definition of TBI and its consequences for patients

Traumatic brain injury (TBI) refers to externally caused damage to the brain. Thereby, the injury is either open, as a result from the scull and dura being penetrated by an object, or closed, due to external force causing rapid acceleration–deceleration, severe rotation, or blow to the head. Severe TBI is associated with loss of consciousness and amnesic phenomena, such as posttraumatic and retrograde amnesia. Posttraumatic amnesia (PTA) refers to the loss of ability to restore new memories, and retrograde amnesia terms the loss of memory reaching backwards from the time of the accident. Severity of TBI is classified by the severity and duration of impairments in consciousness, i.e. with the Glasgow Coma Scale (Teasdale, Murray, Parker, & Jennett, 1979), or by the duration of PTA. Another method is to classify the severity based on the location and extent of brain damage using CT scans (Association for the Advancement of Automotive Medicine, AAAM,

[2] Because the research literature on PTS reactions in significant others of patients with life-threatening illnesses is reviewed in two of the central publications of this PhD thesis (see sections 4.1and 4.3), this issue will not be addressed in more detail here.

2001)[3]. The heterogeneity of methodology makes comparisons of TBI studies somewhat difficult. In Switzerland, severe TBI affects approximately eight individuals in 100000 per year (von Elm et al., 2008). Further epidemiologic studies showed that in most cases severe TBI resulted from road traffic accidents or falls (Andriessen et al., 2011, for an overview). Because pathology and clinical presentation of TBI are highly heterogeneous, providing individual prognoses of treatment outcomes is extremely difficult (Bartles & Wallesch, 2000, for an overview). In addition to high mortality, severe TBI is associated with disabling consequences that highly vary in severity. Depending on the localisation and extent of brain damage the outcome continuum stretches from complete re-establishment of the pre-traumatic functional status on one end to ongoing coma on the other. In between, patients suffer from mild to severe difficulties, such as cognitive deficits concerning perception, attention, concentration, and memory functions, as well as impaired communication, emotion regulation and impulse control. These impairments can either be transient or persist at long-term. Furthermore, the problems caused by severe TBI can impair interpersonal relationships and functioning in various life domains, e.g., the ability to work, perform social roles, and participate in leisure activities.

Why can severe TBI be perceived as a PTE? First, severe TBI is a life-threatening condition, with fatal outcome in approximately 50% of the cases (Andriessen et al., 2011). Per definition it happens accidently and therefore very sudden, unpredictable, and mostly uncontrollable by the individual. Acute life-threat makes emergency treatment necessary, often including neurosurgery and treatment in ICU which has been related to posttraumatic stress in both patients and their next of kin (see section 1.3.1, p. 14, and section 1.3.2, p. 17). Furthermore, a major strain for both is that the prognosis following severe TBI remains unclear, sometimes even for several months. In addition, patients and their significant others are faced with the threat or reality of persistent disability and/or change of personality in the patient. It is therefore not surprising that severe TBI has been discussed and studied as PTE causing mental health problems in patients and their significant others.

Is there PTSD after severe TBI?

There is an ongoing debate on whether individuals can develop PTSD after (severe) TBI (Bryant, 2001; Carlson et al., 2011; Harvey, Brewin, Jones, & Kopelman, 2003;

[3] A more detailed description of these measures is provided in Sub-study I (see section 4.1, p. 53).

King, 2008; Sbordone & Ruff, 2010; Sumpter & McMillan, 2005; Zatzick et al., 2010). It has been argued that the lack of memory for the accident and ongoing PTA would protect against PTSD (Harvey, Kopelman, & Brewin, 2005). However, when studying large samples with consecutively admitted patients, studies have, indeed, revealed similar PTSD rates compared to non-TBI trauma populations (Harvey et al., 2003, for an overview). Furthermore, the possibility of a co-occurrence becomes more and more evident with regard to current military missions. Thereby, many soldiers returning from Iraq or Afghanistan suffer from both the consequences of TBI and PTSD (Morissette et al., 2011). Bryant (2001) and Harvey et al. (2005) have proposed theoretical considerations on why and how PTSD might emerge after an unconsciously experienced PTE, e.g., through implicit processing, fear conditioning, memory reconstruction, post-amnesia trauma, and additional post-trauma stressors due to TBI.

Stress on significant others

Immediate and long-term consequences pose a significant strain on the patients' families, friends and otherwise closely related individuals. At short-term significant others are faced with the threatened death of their loved one, and later they may have to deal with the patients' ongoing functional disabilities and deficits in social skills. At the same time it is them who have to decide on treatment options in case the patients are not able to, and who provide primary care for the patient. Therefore, similarly to the significant others of individuals suffering from chronic illnesses, the patients' significant others take on a *dual role* (Revenson, 2003): They cope with their own stress caused by the injury and simultaneously they are expected to provide coping assistance to the patient. Verhaeghe, Defloor, & Grypdonck (2005) reviewed the literature on the family member's psychological reactions to TBI published between 1970 and 2004 and concluded that the level of distress is "such that professional intervention is appropriate" (p. 1004). However, to my best knowledge only one report has focused on posttraumatic stress symptoms in TBI patients' significant others (Courtney, 1997)[4]. It is important to note that poorer mental health in the patients' caregivers has been linked to worse treatment outcome of the patients (Sander et al., 2002; Taylor et al., 2001; Vangel, Rapport, & Hanks, 2011).

[4] Note that the literature on psychological consequences of (severe) TBI on family members is described in more detail in sub-study I (section 4.1) and sub-study III (section 4.3).

1.3.4 Interpersonal processes in relation to medical trauma

Compared to the fairly novel interpersonal approaches in psychotraumatology reviewed above (see section 1.2, p. 2), the interest in social factors that influence the individual's psychological adaptation to severe—but not necessarily traumatic—stressors such as physical illnesses has a somewhat longer tradition establishing concepts like dyadic coping or social support in dyads (Badr, Carmack, Kashy, Cristofanilli, & Revenson, 2010; Bodenmann, 1997; Fincham & Beach, 2010; Gmelch & Bodenmann, 2007; Knoll & Schwarzer, 2005; Revenson, Kayser, & Bodenmann, 2005; Revenson & Klayman, 2010; Schwarzer & Knoll, 2007; Winkeler & Klauer, 2003). Some theories about psychological distress following potentially traumatic medical conditions have included social interaction characteristics, e.g., in relation to paediatric medical trauma (Kazak et al., 2006) and cancer (Lepore, 2001; Manne & Badr, 2008).

Lepore (2001) suggested the social-cognitive processing model of emotional adjustment to cancer. Expanding the cognitive processing theory (Horowitz, 1986), the model suggests that social contexts modulate how individuals feel and think about their illness, about themselves, and their social world. Thereby, the stress reducing effect of cognitive processing via cognitive integration of traumatic experiences and desensitization to cancer-related negative emotions can be both enhanced and hindered by social interactions. Lepore (2001) proposes that positive social reactions foster frequent discussions of cancer-related thoughts and feelings, and, in this way, support meaning making. Furthermore, it helps re-establishing a positive self-concept and more positive assumptions about the world, and provides the individual affected by cancer with a sense of control over negative emotions. On the other hand, unsupportive social reactions would increase psychological distress. In addition, it diminishes the chances of habituating to cancer-related negative affect. And because no alternative perspectives are available the individual continues searching for the meaning of the bad things happening to him or her. Particular negative social reactions emphasized by the author are perceived *social constraints on the disclosure* of distressing aspects of the illness. Lepore and Revenson (2007) defined social constraints on disclosure as subjective and objective conditions that restrain individuals from talking about their experience and related thoughts and feelings. This can be any behaviour by others that makes one feel unsupported, rejected or misunderstood, and consequently prevents further disclosure attempts.

Thereby, constraints are perceived to emerge transactionally through mismatch between desired and received social reactions. The relationship between social constraints on disclosure and poorer mental health has been supported by several studies providing some evidence for the assumed mediation through less cognitive processing of traumatic stress (Belsher et al., 2011; Lepore et al., 1996; Mallinger, Griggs, & Shields, 2006; Manne, 1999). It is important to note that the empirical support for the social-cognitive processing model brought together by Lepore (2001), is rather indirect. Instead of showing that positive social reactions enhance cognitive-emotional processes in the adaptation to cancer, they reversely demonstrate that negative social interactions correlate with a higher frequency and a stronger impact of cancer-related intrusions, more avoidant behaviours and thoughts, and more severe cancer-related distress in comparison to individuals that do not report such constraints. This is in line with the research by Ullman (2008) that puts more weight on the negative social reactions in determining the response to traumatic stress and disclosure attempts (see on page 3). Therefore, despite the theoretical persuasiveness of Lepore's social-cognitive processing model (2001), the underlying mechanisms remain yet unclear.

Similar to the cognitive-behavioral interpersonal theory of PTSD by Monson et al. (2010), the relationship intimacy model of couples' psychosocial adaptation to cancer (Manne & Badr, 2008) applies a dyadic-level approach to describe the interplay between social interaction variables and psychological adjustment to a severe stressor. Thereby, the perspective is explicitly on the couple dyad. The model proposes interpersonal intimacy and relationship quality enhancing processes to be the primary mechanisms of promoting the dyad's adjustment to cancer in terms of psychological and marital adaptation. Manne and Badr (2008) described their model as an overarching heuristic approach. It combines parts of resource theories that declare the marital relationship to be the major resource of support but maintain an individual-centred approach (e.g., social-cognitive processing theory), with dyadic-level theories that conceptualise cancer as a stressor primarily affecting the couple as a unit, and make assumptions on how couples maintain relationship quality (e.g., relationship resilience models, interpersonal process model of intimacy). One of the key relationship processes which is perceived to contribute to relationship intimacy and therefore to adaptation is *reciprocal disclosure*. The interpersonal process model of intimacy by Reis and Shaver (as cited in Manne & Badr, 2008) suggests that

relationship intimacy is created by two components: self-disclosure (see the description on page 13) and perceived partner responsiveness, i.e., signalising understanding and acceptance of what is being said as well as caring for the speaker. Applying a multi-level approach with dyads affected by head and neck or lung cancer, Manne and Badr (2010) found the proposed mediation effect of relationship intimacy on the association of cancer-related communication and psychological distress. The authors concluded that reciprocal disclosure can enhance relationship intimacy and thereby the couple's adaptation to cancer.

To conclude, frameworks on interpersonal processes in the adjustment to severe illness are somewhat more advanced in conceptualising central mechanisms of the interplay between social contextual variables and psychological adaptation to severe or traumatic stress. The reviewed theories have in common that they particularly emphasise the role of stressor-related communication processes and by conceptualising disclosure as a reciprocal process that includes social reactions ranging from responsiveness on the positive end to disclosure constraints on the negative. When studying interpersonal trauma-related processes in the aftermath of severe illnesses, I propose to combine the more general interpersonal models of PTSD, e.g., the CATS model, the CBIT, and the socio-interpersonal model of PTSD (see section 1.2.2, p. 6) with these frameworks to apply an interpersonal perspective on traumatic stress in general and at the same time to understand the underlying mechanisms of the social interaction and health link.

2 THE CURRENT WORK

This section provides a short summary of each of the three publications that form the empirical basis of this PhD thesis[5]. Beforehand, the design of the PEBITA cohort study will be presented because the data of all three sub-studies were drawn from this research project. Afterwards, the Disclosure of Trauma Questionnaire (DTQ, original German version: Müller et al., 2000) will be described in more detail as well as the changes that were done by the author in order to derive a measure of dysfunctional disclosure tendencies in dyads (DTQ–dyads; Pielmaier & Maercker, 2009).

2.1 Methods

2.1.1 PEBITA: a Swiss cohort study

PEBITA stands for the research network studying 'patient-relevant endpoints after brain injury from traumatic accidents', a prospective cohort study that investigated the incidence and one-year outcome of severe TBI in Switzerland[6]. The PEBITA study was conducted in the German and French speaking parts of Switzerland between May 21, 2007, and April 15, 2011. All eleven emergency centres with neurosurgical facilities participated. To identify predictors of treatment outcome, a large number of potentially influencing variables were assessed during pre-clinic, in-hospital emergency care, neurosurgical intervention, intensive care treatment, and rehabilitation. These data were taken from medical charts. Furthermore, to assess different indicators of the patient's recovery such as the functional and neuropsychological status as well as health related quality of life, the patients were interviewed at three, six, and twelve months after the accident (PEBITA follow-up study). The follow-up sessions were conducted by clinical psychologists, including the author of this PhD thesis, who visited the patients at their homes or at hospital. To obtain informed consent for participation at an early point after the accident and to objectify assessments of the patient's recovery status, also a significant other (*proxy*) of the patient was recruited for PEBITA. Furthermore, with one nested study, PEBITA investigated the stress and burden of severe TBI on proxies. To be included in the PEBITA study, patients were required to be at least sixteen years old, and to have been admitted to one of the participating emergency centres after sustaining

[5] The full text of the articles is provided in section 4 on page 53.
[6] See http://www.pebita.ch/.

TBI from blunt or penetrating trauma with an Abbreviated Injury Scale (AIS; AAAM, 2001) score of four or five, indicating *severe* or *critical* injury[7]. Furthermore, TBI survivors were excluded for PEBITA's follow-up study, if no contact details were available, the patient lived abroad, or if the patient and the proxy did not speak any of the national languages. Patients' significant others were eligible to participate if they were a parent, romantic partner, close friend, child, or other relative. Thereby, proxies were either the person to whom medical staff referred to in the first days after injury when the patients were not able to make decisions themselves, or the person indicated by the patient as being most closely related to them. With regard to the specific research questions of this PhD project, additional in- and exclusion criteria were applied in the three sub-studies (see sections 4.1, 4.2, and 4.3). *Figure 1* presents the design of the nested study for patients and proxies.

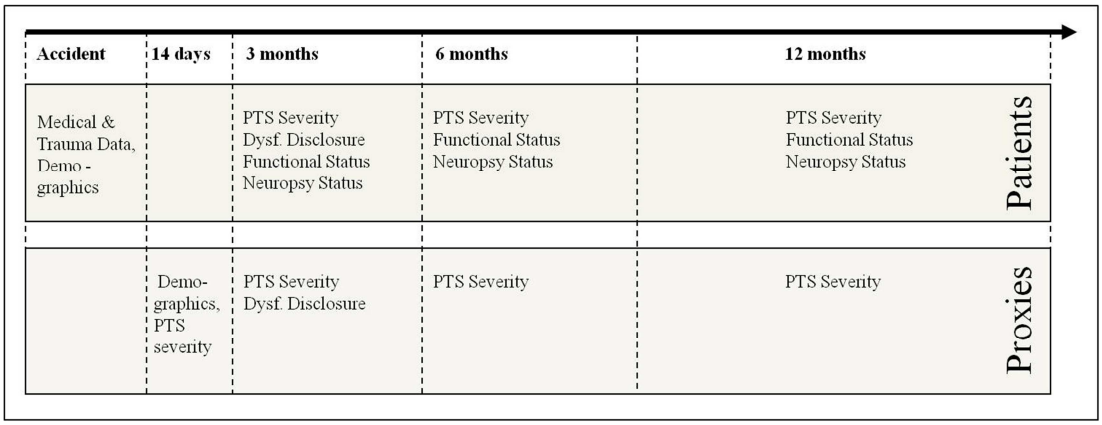

Figure 1. Design of PEBITA's nested study on the psychological consequences of severe TBI on patients and proxies.

PTS = posttraumatic stress symptoms; dysf. disclosure = dysfunctional disclosure tendencies, neuropsy status = neuropsychological status. Further descriptions of the assessment instruments used in this study are provided within the three publications (see section **4**, p. 53).

2.1.2 The Disclosure of Trauma Questionnaire–Dyads

The original version of the Disclosure of Trauma Questionnaire (DTQ, Müller et al., 2000) was developed deductively mainly on the basis of Pennebaker et al.'s work (see on page 10). Thereby, items capturing different aspects of an individual's perception of his or her communication about the traumatic experience were rationally generated. This concerned attitudes towards trauma disclosure, the

[7] A more detailed description of this measure is provided in Sub-study I (see section 4.1, p. 53).

emotional way of disclosing, e.g., crying or reporting with diminished affect, cognitive aspects such as the coherence of the report as well as perceived own reactions during disclosure, e.g., trembling or feeling sad. The item pool was evaluated by experts in PTSD treatment and answered by a sample of 178 former political prisoners of East Germany. Exploratory factors analyses revealed the questionnaire to comprise three factors which were named (1) *conditions of talking*, later changed into *urge to talk*, 13 items, e.g. "I feel like I need to talk about it a lot"; (2) *conditions of saying nothing*, later changed to *reluctance to talk*, 11 items, e.g., "I find it difficult to talk about it"; and (3) *emotional reactions*, later changed to *emotional and physical reactions during disclosure*, 10 items, e.g., "Describing my experiences makes me feel very sad". Whereas the third subscale was moderately correlated with the other two, the subscales reluctance to talk and urge to talk were found to be independent from each other. Furthermore, the DTQ was positively associated with PTSD symptom severity after controlling for standard predictors of PTSD (Müller et al., 2000). These results were replicated in a series of studies with different trauma populations (Maercker et al., 2009; Müller & Maercker, 2006; Mueller et al., 2008; Mueller et al., 2009). To receive a short version of the DTQ the original 34 items were reduced to the four items on each subscale which had the highest factor loadings in the first evaluation study (Müller et al., 2000). The abbreviated DTQ proofed to be equal to the original version with respect to internal consistency and the size of associations with PTSD measures (Müller et al., 2011). Because the self-reported style of trauma disclosure captured by the DTQ assesses rather problematic tendencies of trauma communication, it was termed *dysfunctional disclosure tendencies* in this PhD thesis.

To assess dysfunctional disclosure tendencies in dyads the DTQ short version was slightly changed into the Disclosure of Trauma Questionnaire–Dyads[8] (DTQ–dyads; Pielmaier & Maercker, 2009) providing two versions: one for each individual in the dyad. Both versions equally assess the self-report on each of the responding individual's dysfunctional disclosure style. The only difference is in the instruction section, which addresses either the patient, or the proxy, and asks both of them to relate the statements on disclosure to the corresponding significant other in the dyad. To further enhance this focus the wording of some items was slightly changed, e.g., the original item "I find it difficult to talk *to people* about the incident" was changed

[8] The DTQ–dyad is provided in the appendix on page 41

into “I find it difficult to talk *to him/her* about the incident”. We assumed that the other individual in the dyad was not necessarily the only recipient of the respondent’s disclosure, and therefore we doubled these items to additionally ask for disclosure tendencies towards other people (e.g., “I find it difficult to talk *to other people* about the accident”). Respondents are instructed to answer both items. In order to maintain comparability, the answering format of the original DTQ was kept inviting participants to indicate their agreement with the 14 statements on a six-point Likert scale ranging from 0 (*not at all*) to 5 (*completely*).

2.2 Proxy’s Posttraumatic Stress Symptom Severity in the First Weeks Post-accident (Sub-study I)

2.2.1 Background and objectives

Sub-study I (Pielmaier & Maercker, 2011; see section 4.1, p. 53) investigated the proxies’ PTS reactions at an early stage after the accident and aimed to identify predictors of PTS symptom severity. To our best knowledge, no study had yet reported on the short term stress response to severe TBI of a significant other. In line with previous research that studied the impact of TBI on the relative’s mental health more broadly with respect to depressive and anxiety symptoms assessed at varying time points post-injury (Verhaeghe et al., 2005, for an overview), it was expected that proxies would report significant PTS symptom levels in the first weeks. Furthermore, a number of potential predictors of the proxy’s symptom severity were tested. Of the standard etiological factors of PTSD (Brewin et al., 2000; Ozer et al., 2003) only proxy’s gender was assessed in this study. Because research provides evidence that the patients’ romantic partners are more affected by their next of kin’s illness than other relatives (Kreutzer, Gervasio, & Camplair, 1994b; Paparrigopoulos et al., 2006), type of relationship was included into the analyses. Finally, we examined the predictive power of indicators of the trauma *dose*, such as the severity of TBI, the patient’s overall injury severity, whether surgery was performed, and whether the patient was still in coma and in ICU at the time of the assessment of the proxy’s PTS symptom severity. It was hypothesized that higher PTS severity would be associated with proxy’s female gender, being a romantic partner of the patient, and with higher severity of the patient’s physical trauma.

2.2.2 Methods

Data stem from the PEBITA study conducted in the French speaking part of Switzerland (Romandie) between June, 2007, and May, 2008. To assess short-term PTS symptom severity, N = 69 proxies answered the Impact of Event Scale–Revised (IES–R, Weiss & Marmar, 1996; French version by Brunet, St-Hilaire, Jehel, & King, 2003) once within the first month after the accident of their significant other (*Me* = 11; range = 5 – 23 days). Most of the proxies were female (78%), and romantic partners (44%) or parents (36%) of the patient. The corresponding patients had sustained the TBI mainly from road traffic accidents (42%) or falls (38%). The patient's conscious state was severely impaired in 54% of the cases as indicated with a Glasgow Coma Scale (GCS, Teasdale & Jennett, 1974; Teasdale et al., 1979) score between three and eight at admission to the emergency centre. About 81% of the patients required intensive care treatment.

2.2.3 Results

Results revealed a mean IES–R sum score for intrusion symptoms of *M* = 13.38 (*SD* = 7.26), of *M* = 8.91 (*SD* = 75.94) for avoidance, and of *M* = 9.07 (*SD* = 76.75) for the hyperarousal subscale. Applying the cut-off score of 33 for the total IES–R sum score suggested by Creamer, Bell, and Failla (2003), a clinically significant level of PTS symptoms was observed in 36 proxies (52.2%). PTS symptom severity was independent from the time that had elapsed between the accident and administration of the IES–R. Furthermore, the level of symptoms was significantly higher in women, and no association was found with respect to the type of relationship between patient and proxy. The only indicators of the patient's injury severity that were significantly associated with the proxies' IES–R subscale values were the GCS scores assessed at the accident scene and on hospital admission. Thereby, higher PTS symptom severity was related to a lower state of consciousness in the patients.

2.2.4 Discussion and conclusions

The findings are in line with previous research that observed higher levels of distress in significant others of patients with life-threatening illness (Auerbach et al., 2005; Azoulay et al., 2005; Bunzel et al., 2007; Chui & Chan, 2007; Dew et al., 2004; Jones et al., 2004; McAdam, Dracup, White, Fontaine, & Puntillo, 2010; McAdam & Puntillo, 2009; Noble & Schenk, 2008; Paparrigopoulos et al., 2006). Therefore, we concluded that experiencing severe traumatic brain injury in a significant other may,

indeed, be a traumatic experience causing posttraumatic stress symptoms in a large proportion of individuals shortly after the accident. Regarding the high participation of female proxies in this study, conclusions on gender differences should be drawn with caution. Possible explanations are discussed regarding the finding that only some characteristics of the patient's injury correlated with the proxies' PTS while others did not, especially when assessed simultaneously to the IES–R scores. Finally, data should not be over-interpreted because PTS was assessed cross-sectionally at a very early time point post-injury. Therefore, longitudinal research is necessary to investigate the long-term impact of severe TBI on proxies and to further investigate associated risk factors.

2.3 The Role of Dysfunctional Disclosure Tendencies in Dyads (Sub-study II)

2.3.1 Background and objectives

The first aim of Sub-study II (Pielmaier & Maercker, 2011; see section 4.2, p. 53) was to replicate previous findings on dysfunctional disclosure tendencies in patients with life-threatening injury and their significant others. Secondly, we aimed to study interpersonal associations among the individuals' dysfunctional disclosure styles and their PTS reactions at a dyadic level. It was expected that dysfunctional disclosure style would be related to more pronounced PTS symptom severity within the individual with effect sizes similar to those observed in previous studies with samples from other trauma populations such as victims of violent crime (Mueller et al., 2008), former political prisoners (Müller et al., 2000), and refugees from Chechnya (Maercker et al., 2009). In addition to the intrapersonal association, we hypothesized to find mutual effects at the level of the dyad with the patient's dysfunctional disclosure style affecting the proxy's adaptation to trauma and vice versa.

2.3.2 Methods

This sub-study used cross-sectional data from a subsample of N = 70 patient-proxy-dyads recruited for PEBITA within the German speaking part of Switzerland. Self-reports on dysfunctional disclosure tendencies were assessed with the DTQ–dyads (Pielmaier & Maercker, 2009; see section 2.1.2, p. 25, and in the appendix on page 139) at three months after severe TBI as part of the first follow-up interview for the PEBITA study. To assess PTS in proxies, the Impact of Event Scale–Revised (IES–R, Weiss & Marmar, 1996; German version by Maercker & Schützwohl, 1998) was

used. The severity of PTS symptoms in the patients was assessed with the Short Screening Scale for DSM-IV PTSD (Breslau, Peterson, Kessler, & Schultz, 1999; German version by Siegrist & Maercker, 2010) which was administered as a semi-structured interview.

2.3.3 Results

Although both the levels of PTS symptom severity and self-reported dysfunctional disclosure tendencies were rather low, data provided enough variability to investigate the hypothesised associations. As it was expected, for both the patients as well as for the proxies, significant correlations were reported between dysfunctional disclosure tendencies and psychopathology. Coefficients were comparable to those found in the study with crime victims in Germany (Mueller et al., 2008). Furthermore, regression analyses predicting PTS symptom severity revealed that—when regarded within the individual—the DTQ total scores had incremental validity above and beyond basic predictors such as gender, age, and trauma severity. Additionally, the interaction between the patients' and proxies' disclosure styles explained further proportions of the variance in the patients' PTS symptom severity. With a beta coefficient of .22, higher scores on the proxies' DTQ enhanced the positive association between the patients' DTQ scores and PTS symptoms. There was no effect of the patient's dysfunctional disclosure style on proxy's PTS.

2.3.4 Discussion and conclusions

The findings suggest that within the individual—regardless whether patient or proxy—endorsing a dysfunctional disclosure style is related to poorer psychological adjustment following severe traumatic brain injury. Moreover, this intrapersonal association can be exacerbated by dysfunctional disclosure tendencies on the part of a significant other. Results were discussed on the background of the social-cognitive processing model of adjustment to cancer suggested by Lepore (2001; see section 1.3.4, p. 21). Thereby, it is possible that proxies reporting a problematic disclosure style could have posed social constraints on the patients' disclosure intentions. Furthermore, the findings were interpreted as being in line with previous findings on mutual influences in the adaptation to trauma (e.g., Monson, Gradus et al., 2009; Renshaw et al., 2008, see section 1.2.1, p. 5), and to contribute to the expanding literature on the crucial role of social interaction in trauma recovery. To generalize

the results beyond dyads affected by severe TBI, further research with other types of PTE is required.

2.4 Trajectories of Posttraumatic Stress Symptoms in Proxies Across the First Year Post-accident (Sub-study III)

2.4.1 Background and objectives

Sub-study III (Pielmaier, Milek, Nussbeck, & Maercker, 2012, see section 4.3, p. 81) investigated the longitudinal trajectories of PTS symptoms in proxies across three, six, and twelve months after the accident. Previous research on the impact of severe TBI on the patients' significant others has demonstrated that some, but not all, individuals suffer from long-term psychological distress (Ponsford & Schonberger, 2010). However, longitudinal data on traumatic stress responses after a potentially traumatic medical condition is rare. Therefore little is known about the course of PTS symptoms in this particular trauma population. In line with the work by Bonanno and colleagues (e.g., Bonanno, 2004) we expected to find at least two different symptom trajectories. A larger proportion of the sample was hypothesised to report very low levels of symptoms across the course of one year after the patients' head injury (*resilient* group). At least one other and comparatively smaller group of proxies was expected to show higher symptom levels. Because trajectory classes varied among other studies that had applied a similar approach (e.g., Armour, Shevlin, Elklit, & Mroczek, 2011; deRoon-Cassini et al., 2010; Dickstein, Suvak, Litz, & Adler, 2010), we did not hypothesise a specific number or shape of symptom trajectories. As a second aim we examined potential predictors of the identified symptom courses. Again, the proxy's gender and type of relationship to the patient were expected to be related to more severe PTS symptoms. Thereby, female gender and being in a romantic relationship with the patient rather than being a child, parent or friend was supposed to be associated with the assignment to the class(es) of higher symptom severity. Furthermore, as an indicator of the trauma dose, we expected the patients' functional status at three months after injury to be associated with higher distress, and likewise the proxies' self-reported dysfunctional disclosure tendencies.

2.4.2 Methods

Sub-study II used prospective longitudinal data from a subsample of N = 135 proxies recruited for PEBITA within the German speaking part of Switzerland. In addition to the general inclusion criteria for PEBITA's nested study on the psychological effects

of severe TBI on significant others, it was required that proxies had at least participated in two of the three assessment points. At three, six, and twelve months after the patients' injury, proxies filled in the Impact of Event Scale–Revised (IES–R, Weiss & Marmar, 1996; German version by Maercker & Schützwohl, 1998) to assess PTS symptom severity. Additionally at three months, the proxies' dysfunctional disclosure tendencies were captured with the proxy version of the DTQ–dyad which basically equals the abbreviated DTQ (Müller et al., 2000; Müller et al., 2011; see section 2.1.2, p. 25). The patients' functional deficits due to brain injury were administered with the Glasgow Outcome Scale (GOS, Jennett, Snoek, Bond, & Brooks, 1981). To reveal distinct patterns of symptom trajectories we employed latent growth mixture modelling (LGMM) analysis (Curran & Hussong, 2003; Jung & Wickrama, 2008; Muthén, 2004) calculated with Mplus (Muthén & Muthén, 1998-2000). To identify the final number of growth classes, models with one to five class solutions were compared using conventional fit indices, entropy values, and the bootstrap likelihood ratio test. Symptom trajectories were modelled separately with respect to the three symptom clusters of PTSD as assessed with the IES–R: intrusions, avoidance, and hyperarousal. We then compared class assignments across the three symptom clusters. Finally, the prediction of group membership according to the second hypothesis was tested with logistic regression analysis.

2.4.3 Results

Mean levels of IES–R scores revealed a low level of overall distress in proxies with a small decrease across three, six, and twelve months after the accident. As indicated by the GOS scores, nearly half of the corresponding patients had recovered to their pre-injury level of functioning at the time of the first assessment. However, about 20% of the patients suffered from ongoing disability across the whole year. With LGMM analyses the best fitting model solution was found with two classes for each PTSD symptom cluster. Thereby, each model revealed one large class of very low symptom levels capturing 87%, 92%, and 70% of the sample with respect to intrusions, avoidance and hyperarousal symptoms respectively. For each symptom cluster a second class was found that started with more pronounced PTS symptoms at three months after the accident, and followed somewhat differing trajectory patterns afterwards. To integrate the results of the three symptom clusters, two groups were built: The *resilient* group that comprised the 85 (63%) individuals that were assigned

to the class of low symptom levels for each of the three symptom clusters; and the *higher distress* group capturing all proxies that had been assigned to the class of more severe symptom levels at least for one symptom group. The only significant predictor of membership to the higher distress group found by logistic regression analysis was the DTQ total score with *OR* = 5.38, 95% CI [2.31; 12.55].

2.4.4 Discussion and conclusions

The findings are congruent with the hypothesis that there are distinct patterns of PTS symptom trajectories among significant others of patients who survived severe traumatic brain injury across one year following the accident. In line with research on the course of psychological distress after other PTE types (e.g., Bonanno, 2004), by far the largest number of proxies did not endorse any symptoms or only very low distress levels. However, the level of symptoms in the group of participants with more pronounced PTS was slightly higher than the symptom severity found in a study with survivors of motor vehicle accidents using the same measure of PTS (Beck et al., 2008). Although the shape of growth curves differed between the symptom clusters, one general finding is that higher distress levels tended to persist across the three time points. To explain why the results of Sub-study III differed from other reports on the course of PTSD (e.g., Armour et al., 2011) we discussed the role of certain characteristics of this particular traumatic stressor. Furthermore, once again the finding of a profound association between self-reported dysfunctional disclosure style and more severe PTS symptoms was replicated (e.g., Maercker et al., 2009; Müller et al., 2000; Mueller et al., 2008), in this case with dysfunctional disclosure tendencies predicting persistent distress. Because the number of the examined predictors was limited, and no other psychological measures were included in the regression model, this finding should be treated with caution. In addition, methodological limitations were discussed. To conclude, Sub-study III provides preliminary evidence that PTS symptoms persist in a subgroup of significant others after severe TBI. The risk of a chronic symptom course might be detected at an early point by carefully monitoring the proxy's distress level as well as interpersonal characteristics such as dysfunctional disclosure tendencies.

3 OVERALL DISCUSSION

In the following, the three sub-studies' results will be integrated in an overall discussion to draw general conclusions as well as clinical implications, and finally, to provide ideas for future research based on the current findings. Main focus of the discussion is on investigating the contribution of this PhD thesis to an interpersonal perspective on trauma and PTSD.

3.1 Integration of Findings

The three sub-studies can be structured according to their objectives which addressed two main directions of interest: (1) PTS reactions of significant others including the results of the sub-studies I and III, and (2) the role of dysfunctional disclosure style with results of the sub-studies II and III. Before discussing the findings against the background of current knowledge they will be descriptively located within the interpersonal theories of PTSD reviewed in the theoretical background section (see section 1.2.2, p. 6).

3.1.1 Locating the findings within interpersonal theories of PTSD

Studying the impact of potentially traumatic events (PTE) on significant others (sub-studies I and III) shifts the focus from the primary trauma survivor to the proximal social context. This perspective is promoted by each of the reviewed interpersonal PTSD theories: the couple adaptation to traumatic stress model (CATS, Nelson Goff & Smith, 2005), the cognitive-behavioral interpersonal theory (CBIT, Monson et al., 2010), and the socio-interpersonal model of PTSD (Maercker & Horn, 2011), see section 1.2.2, p. 6). Although it includes the psychological distress of both the patient and the spouse as an outcome, the interpersonal theory of adaptation to cancer by Manne and Badr (2008) does not pay much attention to the single individuals within a social system. The theory's emphasis is particularly on the dyadic processes of adjustment. The social-cognitive processing model proposed by Lepore (2001) does not address the impact of trauma/PTSD on significant others. Therefore, this theoretical framework is less relevant to the interpretation of the sub-studies I and IIIs' results.

Locating the concept of trauma disclosure within the interpersonal models depends on the perspective. As has been noted, disclosure of trauma is a multifaceted phenomenon (Müller & Maercker, 2002), and the conceptualisation in terms of

problematic or dysfunctional disclosure tendencies allows for several perspectives. This view will be adopted when discussing the results of the sub-studies II and III (see section 3.1.3, p. 37) where theoretical explanations are structured from an intra- to an interpersonal perspective. Mueller and colleagues explicitly described the disclosure tendencies assessed with the DTQ to be intrapersonal phenomena of the individual disclosing because it captures "different attitudes regarding disclosure" (Mueller et al., 2008, p. 161), and an "individual's intention to disclose traumatic events" (p. 162). Therefore, with regard to the socio-interpersonal model of PTSD (Maercker & Horn, 2011) dysfunctional disclosure tendencies would be best located at the level of the individual. Similarly within the CATS model it would be situated at the component of the individual levels of functioning which captures all the intrapersonal processes of trauma adjustment for both the primary and secondary victim (Nelson Goff & Smith, 2005). Accordingly, the CBIT (Monson et al., 2010) classifies the intrapersonal facet of dysfunctional disclosure tendencies within the individuals comprising the regarded dyad. All the three models imply that these intrapersonal phenomena happen embedded in a social context and are therefore influenced by the behaviour of other people and vice versa. In Sub-study II this interpersonal aspect of disclosure was explicitly examined. Thus, these findings of Sub-study II are best represented on the next level of the socio-interpersonal model of PTSD (Maercker & Horn, 2011), the level of close social relationships which corresponds to the dyadic levels primarily focussed with the CATS model, the CBIT, and the interpersonal theories of adaptation to cancer (Lepore, 2001; Manne & Badr, 2008). Because potential influences on and from the more distant social context, e.g., societal values and cultural habits concerning disclosure, were not addressed in any of the three sub-studies, the third level of socio-interpersonal processes in relation to PTSD according to the model by Maercker and Horn (2011) is less relevant to this work. However, it might be an interesting additional perspective in future research (see section 3.3.2, p. 46).

3.1.2 The impact of severe TBI on significant others

Posttraumatic stress reactions in the patients' significant others were primarily focussed in the sub-studies I and III. Both studies demonstrated that experiencing severe TBI and its consequences in the romantic partner, relative, or friend can be a traumatic experience eliciting symptoms of PTS at short- and at long-term. The results were considered to be comparable to findings on PTS reactions following

other medical conditions experienced either in a significant other (see section 1.3.2, p. 17) or by oneself (see section 1.3.1, p. 14), and following other types of PTEs (see section 1.3.1, p. 16). Furthermore, they reflect the burden of the TBI patients' next of kin (see section 1.3.3, p. 20). More precisely, with cross-sectional data Sub-study I showed that within the first month after the accident more than half of the proxies reported clinically significant levels of PTS. This cross-sectional finding is similar to what was found in a relative sample of patients at high risk of dying in ICU (McAdam et al., 2010). The heightened level of PTS symptoms shortly after the accident can be attributed to the momentary shock posed on the individual from the injury-caused threat of potentially losing a close relative or friend. Because stress reactions are known to be stationary for most individuals exposed to trauma (Kessler et al., 1995; Peleg & Shalev, 2006), PTS symptoms were expected to naturally decrease within the first weeks after the accident and to only persist in a small subgroup of proxies at long-term. This hypothesis was supported by Sub-study III which found a chronic symptom trajectory at least for one symptom cluster of PTSD in about 37 percent of the sample, whereas less than two percent reported persistent high levels in all the three symptom clusters. Chronic PTS symptom levels had already manifested at the first assessment of this study, at three months after the accident. This is consistent with the finding that pronounced stress symptoms expressed early after injury predicted a chronic course of psychopathology (O'Donnell, Elliott, Lau, & Creamer, 2007). It is important to notice that whereas the group reporting higher levels of distress was small, still, the symptom severity of this subgroup was similar to the one found in a sample of survivors of motor vehicle accidents (Beck et al., 2008). Furthermore, the findings of Sub-study III were considered to be in line with research showing that psychological distress in the TBI patients' significant others can persist for years after the accident (Ponsford & Schonberger, 2010).

In Sub-study III we argued that the failure to detect more than two trajectories can be partly due to the study's design. Moreover, this can be attributed to the nature of the observed trauma type. Both with regard to PTSD in general and concerning PTSD following medical conditions, the role of ongoing stress as a posttraumatic risk factor contributing to the maintenance of PTSD has been highlighted in literature (Brewin et al., 2000; Kangas et al., 2002; Köllner, 2009; Ozer et al., 2003; Schnurr, Lunney, & Sengupta, 2004, see section 1.3, p. 14). For this reason we examined the

impairments in the patients' functional status as a predictor of the proxies' symptom trajectories. Although a trend was reported for proxies of patients with more severe disabilities in various life domains at three months to have a higher risk of being in the group of persistent higher distress compared to proxies of patients with better functioning, this difference was not statistically significant. It is possible that a measure assessing the neuropsychological problems and personality changes would have made a stronger contribution because these impairments are more likely to have an impact on the patients' significant others (e.g., Schönberger, Ponsford, Olver, & Ponsford, 2010). Contrarily to our hypothesis, type of relationship to the patient did not result in differences regarding the impact of TBI on the proxy. This is an important finding suggesting that not only spouses but also family members or other close ones can be affected by traumatic stress. Due to the composition of the sub-studies' samples, with proxies predominantly being female, gender effects were methodologically difficult to investigate. However, the findings of Sub-study I implicate that the common result of females suffering from more severe PTS (Tolin & Foa, 2006) is also true for this specific trauma population.

Disregarding some general limitations concerning the generalisability of the results (see section 3.2, p. 41), the following conclusions can be drawn: The results of Sub-study I and III demonstrate that traumatic experiences such as a life-threatening medical condition may not only impact the individual that is directly affected but also his or her social environment. In clinical practice this is important to notice because psychological distress may impair these individuals' capacities to participate in shared decision making (Azoulay et al., 2005) and to take on the role of caregivers for patients suffering from ongoing disabilities (Revenson, 2003; Verhaeghe et al., 2005; Wells, Dywan, & Dumas, 2005). Furthermore, it is very likely, that beyond the mental health of proxies also the interpersonal relationship between the patient and the proxy is affected. Therefore, it seems indicated to broaden the focus on the individual to the surrounding social world.

3.1.3 The role of dysfunctional disclosure style

Self-reported dysfunctional disclosure tendencies were primarily focussed in Sub-study II with a sample of dyads comprising a patient with severe TBI and a significant other. Sub-study III additionally investigated the role of dysfunctional disclosure style in predicting the proxies' PTS symptom trajectories. Both studies detected the hypothesised positive relationship between perceived reluctance to talk,

urge to talk, and emotional as well as physical reactions during disclosure on one side, and PTS symptom severity on the other. These intrapersonal associations which were evident both for the patients and the proxies replicated previous findings from various trauma populations (Maercker, Mohiyeddini et al., 2008; Müller & Maercker, 2006; Mueller et al., 2009; Müller et al., 2011). As expected, the correlation remained substantial after controlling for several established predictors of PTSD. Thereby, with regard to the proxies, dysfunctional disclosure style was the only significant predictor of PTS symptom severity when investigated cross-sectionally (Sub-study II), and when predicting the proxies' membership to the group of higher distress expressing a symptom trajectory with more severe symptoms across time (Sub-study III).

Moreover, Sub-study II was the first to study the link between perceived dysfunctional disclosure tendencies and more severe PTS symptoms at a dyadic level. Thereby, for the patients the intrapersonal association was potentiated by the level of dysfunctional disclosure style of the proxies. Interestingly, the level of symptom severity was not correlated between patients and proxies. However, their self-reported disclosure tendencies were associated to a small to moderate degree. Examining the enhancing interaction more closely by applying the Jackson-Newman method to identify the regions of significance for the moderator variable, data revealed that for 20% of the dyads, when proxies did not report any dysfunctional disclosure tendencies, the patients' disclosure styles were independent from their levels of symptoms. However, at the other extreme, when proxies endorsed maximum levels of dysfunctional disclosure, the patient's intrapersonal disclosure–PTS link was intensified by almost two times. Therefore, it can be concluded that the potentially negative impact of problematic disclosure tendencies on mental health partly depends on the way a significant other deals with the experience. In addition, the findings further point to the highly complex interplay between inter- and intrapersonal parts of the adaptation process after potentially traumatic events because the interaction effect was not observed with regard to the proxies' PTS symptom severity.

It should be noted that the current work does not base on a theoretical effects model of trauma disclosure. The purpose of this PhD thesis was rather to find a first approach to study previous findings on problematic disclosure tendencies with a dyadic research design and to exploratory investigate potential interpersonal

associations. However, the various conceptualisations of the disclosure of emotional experiences reviewed in the theoretical background of this work provide several starting points to explain the sub-studies' findings (see section 1.2.3, p. 9, and section 1.3.4, p. 21). In the light of the repeated empirical observation, that interpersonal processes are best captured as risk rather than as protective factors (Charuvastra & Cloitre, 2008; Ullman, 2008), it makes sense to conceptualise and test disclosure behaviours and attitudes in a negative way, i.e., as *problematic* or *dysfunctional* disclosure tendencies. The Disclosure of Trauma Questionnaire (DTQ, Müller et al., 2000; see section 2.1.2, p. 25) used in this work captures self-reports about feeling reluctant to disclose the traumatic memory (e.g., not having talked about it, perceiving difficulties when talking about it), experiencing a strong desire to disclose (e.g., feeling compelled to talk about it again and again), and perceiving strong emotional (e.g., feeling tense, feeling sad) and physical reactions (e.g., sweating, trembling) during disclosure. Because correlation studies repeatedly found these problematic patterns of trauma disclosure to be associated with more severe PTSD after trauma (Maercker, Mohiyeddini et al., 2008; Müller & Maercker, 2006; Mueller et al., 2009; Müller et al., 2011), they can either be understood as a cause, a consequence, or a co-phenomenon of the disorder.

Conceiving problematic disclosure tendencies as a consequence of PTSD is supported by research that reports deficits in interpersonal communication stemming from the disorder (e.g., Cook, Riggs, Thompson, Coyne, & Sheikh, 2004). Accordingly, in spite of wishing to disclose the stressful experiences to others, the individual affected by trauma and PTSD could be disabled to successfully express him- or herself (e.g., Charuvastra & Cloitre, 2008). This is supported by the study of Bedard-Gilligan et al. (2011) who found individuals with PTSD to perceive more difficulties in talking about the traumatic experience compared to individuals who survived trauma without suffering from PTSD, notwithstanding that both groups indicated to engage in disclosure equally frequent and equally detailed. In Sub-study II we argued that problematic disclosure tendencies captured with the DTQ may reflect PTS symptoms within communication style (Pielmaier & Maercker, 2011, see section 4.2). Thereby, reluctance to talk is perceived to be a form of avoidance behaviour; urge to talk to reflect intrusions or rumination, and emotional and physical reactions while disclosure to be a manifestation of hyperarousal symptoms. Regardless of whether perceived as a consequence or co-phenomenon of PTSD, such

problematic disclosure tendencies can contribute to maintain the disorder and therefore play a dysfunctional role. This view is suggested indirectly within the theories explaining why disclosure, at least in experimental research, is related to better health (Frattaroli, 2006, for an overview; see section 1.2.3, p. 9). Thereby, problematic disclosure would prevent the suggested beneficial processes involved in trauma disclosure (Müller & Maercker, 2002), such as the habituation to trauma stimuli that constantly reinforce symptoms of PTSD (exposure theory, Bootzin, 1997), structuring the fragmented trauma memory and correcting dysfunctional cognitions (cognitive-processing theory, Pennebaker, 1993), and mobilizing social support (social integration theory, Pennebaker & Graybeal, 2001).

Going one step further towards an interpersonal perspective on disclosure, one could include the reactions of significant others and expect unfavourable patterns of disclosure to be reinforced on the part of a significant other. For example, if a traumatised individual avoids talking about what happened and about thoughts and feelings that might go on causing emotional distress, and his or her significant other refrains from asking or initiating such conversation, it is likely that no such communication will take place. In Sub-study II the patients' and the proxies' disclosure styles were moderately correlated indicating that, e.g., reluctance to talk is in part a mutual characteristic within the dyad. Such phenomena reflect the clinical impression that family members accommodate the PTSD symptoms of the trauma survivor (Fredman et al., 2011), in this case by engaging in mutual (verbal) avoidance behaviour. Contrary to establishing a mutual understanding of the situation, mutual avoidance can contribute to the reinforcement of PTSD symptoms (Monson et al., 2010). Furthermore, in Sub-study II we discussed the observed dyadic interaction effect against the background of the social-cognitive processing theory by Lepore (2001). Thereby, dysfunctional disclosure tendencies on the part of a significant other were perceived as social constraints on disclosure. Even though the primary trauma survivor might have positive attitudes towards talking about what happened, he or she can feel hindered by the other family members' negative reactions to disclosure (e.g., avoiding to touch upon the topic). Similarly, in Sub-study II patients with a significant other endorsing high levels of dysfunctional disclosure tendencies might have felt constrained from disclosing. As a consequence—especially when they had high levels of dysfunctional disclosure

tendencies themselves—this was associated with even more severe PTS symptom severity.

Another explanation on how problematic disclosure may aggravate posttraumatic stress reactions is via the interpersonal relationship. According to the relationship intimacy model of couples' psychosocial adaptation to cancer by Manne and Badr (2008), the effect of talking about illness-related stressful experiences on mental health is mediated by interpersonal intimacy. The authors argue that the more a couple engages in responsive disclosure the closer the relationship, the better the relationship quality, and the better the individual's psychological wellbeing. Accordingly, problematic disclosure tendencies would, especially if practised mutually, lead to more emotional distance within the relationship as well as to more distress for both individuals involved. With this theory, again, the association between problematic disclosure tendencies and poorer health is explained indirectly, in that the supposed beneficial effects of positive interactions are prevented, inhibited, or undermined.

To conclude, this PhD studies' findings on the association between dysfunctional disclosure tendencies and PTS symptom severity can be explained in multiple ways. Depending on the perspective—intra- versus interpersonal—the proposed pathways point to two possible mechanisms: (1) Problematic disclosure tendencies prevent successful trauma processing (or they reflect unsuccessful processing), and (2) problematic disclosure tendencies impair social relationship functioning. Both processes result in poorer psychological adaptation to trauma. This PhD thesis investigated the associations among these variables either with a dyadic but cross-sectional design (Sub-study II) or with a longitudinal but within-person approach (Sub-studies III). Therefore, it is not possible to decide on the underlying mechanisms. However, on the basis of the interpersonal theories and previous studies reviewed above, it seems to be most likely that both pathways proceed simultaneously. In section 3.3.2, p. 46, I present some ideas of future research based on these considerations.

3.2 Limitations

There are some overall limitations that need to be discussed because they were not sufficiently addressed within the three research articles. Apart from the limited sample sizes, one limitation concerns the representativeness of findings both with regard to severe TBI and to other PTEs. The reader might have noticed that different

subsamples of the PEBITA study were used to investigate the particular research objectives of the three sub-studies. At the time of the publication of the three articles and this synopsis, PEBITA's data management was not completed. Therefore, not enough information was available to conduct drop-out analyses, and to compare cases included in the sub-studies' analyses with the complete PEBITA sample. As a consequence, it is not possible to draw any conclusions about the representativeness of the reported data with respect to the whole population of severely brain injured individuals and their significant others in Switzerland. It is possible, that rather those patients and proxies were captured that had better health outcomes which is reflected by fairly low levels of PTS symptoms and low scores of dysfunctional disclosure tendencies. However, data provided enough variability to investigate the research questions. Furthermore, the comparison of our findings with other studies on the psychological consequences of severe TBI is difficult because the studies vary with respect to defining severity of brain injury[9].

Moreover, the representativeness of the sub-studies' findings can be questioned with regard to social aspects of adjustment to PTEs in general. Whereas, several authors have emphasized the potential role of life-threatening medical conditions as traumatic events (Köllner, 2009; Krauseneck et al., 2005; Tedstone & Tarrier, 2003), others have warned not to misuse PTSD and the concept of psychological trauma in the context of severe illnesses. For example, Mundy and Baum (2004) suggested subsuming the mental health problems reported in relation to highly stressful medical conditions rather as generalised anxiety disorder than as PTSD. The population studied with this research project, however, was considered to be an adequate example of a highly disruptive—and potentially traumatic—condition to patients and their significant others, and therefore to provide a good basis to study interpersonal processes. In line with Bonanno (2004) we carefully used the term *potentially traumatic event* instead of *trauma* when referring to severe TBI as the traumatic stressor. Furthermore, we examined TBI-related psychopathology by assessing symptoms of *posttraumatic stress* rather than diagnosing PTSD. However, to generalise the findings beyond dyads affected by severe TBI, the studies need to be replicated with other trauma populations.

[9] Psychological studies prefer length of posttraumatic amnesia as the defining criterion (e.g., Bryant, Marosszeky, Crooks, Baguley, & Gurka, 2001), whereas in medical research, e.g. the PEBITA study, usually the Glasgow Coma Scale score or the Abbreviated Injury Severity score is used to define the severity of TBI.

Furthermore, some general methodological shortcomings need to be addressed. First of all, the three sub-studies were nested within the PEBITA research network, a longitudinal cohort study that was primarily interested in medical aspects of severe TBI. To minimize the burden on participants the number and length of instruments used to assess psychological constructs was limited. Therefore, psychological distress was only captured in terms of PTS, and self-reports on dysfunctional disclosure were the only aspects of trauma disclosure that were studied. Furthermore, especially with regard to the patients' significant others, little information on demographic characteristics and on other predictors of PTSD were collected. Second, aside from the administration of a short clinical interview to assess PTS symptoms of the patients, the sub-studies' data exclusively stem from self-report measures. Self-administered questionnaires have been criticised because they capture only the subjective perspective of the respondent. They are susceptible to the individual's momentary affect when responding and to bias due to retrospective recall (Bolger, Davis, & Rafaeli, 2003; Guay et al., 2006). Some of the discussed limitations to the sub-studies' findings will be addressed in the next section where future research directions will be outlined. Before that, some clinical implications of the results will be summarized.

3.3 Clinical and Research Implications

3.3.1 Implications for clinical practice

Applying an interpersonal perspective on severe TBI is import because the detrimental consequences of brain injury can impact the patient's significant others involving spouses, parents, children, and friends. On the other hand, including the social context in the treatment bears the potential to enhance individual treatment (Kreutzer, Marwitz, Godwin, & Arango-Lasprilla, 2010; Monson et al., 2011; Monson et al., 2010; Sander et al., 2002). From a clinical view explaining causal relationships among trauma-related interpersonal processes is rather irrelevant. More interest lies on identifying those components that either serve as markers for less favourable trajectories or that can be modified by clinical intervention. The three sub-studies' findings contribute to this approach both with regard to the treatment of the psychological consequences of severe TBI and of dyads affected by PTSD.

Treating families affected by severe TBI

As has been mentioned, significant others take on an important role in the process of the patients' recovery and/or care. It is therefore important to carefully monitor the significant other's mental health following severe TBI. The sub-studies' findings indicate that the Impact of Event Scale–Revised (Weiss & Marmar, 1996) is an adequate instrument to detect proxies that might be at risk of less favourable trajectories of psychological distress. Taking account of the potentially long-term negative impact of TBI on patients and their significant others, a number of different interventions to treat mental health problems and impaired family functioning have been suggested. For example, the patients' families received psychological support and education on the possible effects of TBI (e.g., Morris, 2001; Norup, Kristensen, Siert, Poulsen, & Mortensen, 2011; Rotondi, Sinkule, & Spring, 2005; Sinnakaruppan, Downey, & Morrison, 2005). Giving a comprehensive overview on family intervention strategies and principles after brain injury, Kreutzer et al. (2010) concluded that research on the efficacy is still rare and best practice should include psychoeducation, skills training and psychological support. With a broader focus on chronic physical illnesses, a recent meta-analysis on 53 randomised-controlled trials on family oriented interventions reported moderate effects on the mental health of patients and relatives compared to standard treatments (Hartmann, Bazner, Wild, Eisler, & Herzog, 2010). Thereby, relationship focussed interventions showed slightly better effects than sole psychoeducation. According the theory by Manne and Badr (2008, 2010; see section 1.3.4, p. 21) that explicitly emphasises the dyadic level as the focus of treatment, a key component of enhancing couple and family functioning lies within the intimacy generating process of reciprocal disclosure. In line with this, the findings of Sub-studies II and III point to the important role of adequate interpersonal communication with respect to illness-related concerns and emotions. The work by Bodenmann and colleagues showed that communication as well as dyadic coping skills can be trained, resulting in an enhancement of couples' coping with everyday stressors and long-term stabilization of marital relationships (Bodenmann, Bradbury, & Pihet, 2009; Revenson et al., 2005). Such an approach seems to be promising to be translated to couples or other social groups affected by the consequences of severe TBI.

Treating families affected by PTSD

As a reaction to the current military operations in the Middle East—with many service members who return from deployment suffering from combat-related PTSD often in combination with traumatic brain injuries—the US Department of Veterans Affairs has advanced marital and family intervention programs to address these needs. Galovski and Lyons (2004) criticise that most interventions including the veteran's family mainly focus on treating PTSD in the individual affected rather than also targeting the family member's difficulties. As outlined in the theoretical background of this work some interpersonally-oriented inventions for the treatment of families and couples affected by PTSD have been proposed (see section 1.2.2, p. 6). Efficacy studies are rare with only two studies employing a randomized-controlled design to investigate the effects of conjoint therapies for PTSD (Monson et al., 2010). The results show that trauma-focused interpersonal therapy is effective in improving both mental health parameters and interpersonal functioning in terms of enhancing marital satisfaction and problem-solving skills (Glyn et al., 1999 and Sweany, 1987, as cited in Monson et al., 2010).

Most of the proposed couple-based or family therapy approaches for the treatment of PTSD involve a training of communication and problem-solving skills in addition to providing psychoeducation about PTSD (Riggs et al., 2009, for an overview). Beyond that, the cognitive-behavioral conjoint therapy for PTSD (CBCT, Fredman et al., 2011; Monson et al., 2008; Monson et al., 2010; Monson et al., 2004) proposes a particular sequence of interventions in which problem-solving and communication skills are trained first to prepare and strengthen the dyad in order to proceed with conjoint trauma-focussed work at a later stage. Thereby, similarly to the approach by Manne and Badr (2008), the CBCT focuses on enhancing the couple's communication in order to promote the sharing of thoughts and feelings to increase emotional intimacy and to simultaneously decrease symptoms of emotional numbing as well as the (mutual) avoidance of traumatic stimuli and cognitions (Monson et al., 2008). Hence, the therapist encourages the couple to engage in the disclosure of trauma-related issues. The moderating effect of the proxies' dysfunctional disclosure tendencies found in Sub-study II points to the need of such interventions especially for a subgroup of dyads coping with the consequences of severe TBI: those in which both partners employ a dysfunctional disclosure style. It will be the task of future research to study how problematic disclosure tendencies can

be reduced by therapy and how more positive forms of emotional sharing can be trained. Such a *disclosure of trauma skills training* might enhance interpersonally-oriented treatments both for PTSD and for families' adjustment problems when faced with the consequences of severe TBI in a relative.

3.3.2 Directions for future research

In addition to the implications for future research that were discussed within the three publications central to this work (see section 4, p. 53), some general ideas on future research directions based on this PhD thesis will be presented in the following. The proposed improvements are described, again, separated for the two main foci of this work: (1) the impact of life-threatening injury on significant others, and (2) the role of dysfunctional disclosure tendencies as an example of trauma-specific social interaction.

Studying PTS in significant others

With regard to examining stress reactions after experiencing a life-threatening illness in a relative or friend, the research methodology of this work was quite advanced because we applied modern statistical methods to analyse longitudinal data on the proxies' stress reactions (Curran & Hussong, 2003; Jung & Wickrama, 2008; Peleg & Shalev, 2006). Apart from that, several improvements can be done to thoroughly capture the impact of severe TBI on the patients' significant others. First, a psychometrically valid clinical assessment instrument should be used in addition to self-report measures of PTS reactions to quantify clinically significant psychopathology. For example, the Clinician-Administered PTSD Scale (Blake et al., 1995) and the Short Screening Scale for DSM-IV PTSD (Breslau et al., 1999) as a less time consuming alternative can be applied.

Second, in order to capture the full scope of the consequences for significant others, more indicators of health impairments should be assessed that are both specific to TBI and to other potentially traumatic stressors, e.g., symptoms of depression, general psychological distress, caregiver burden, and quality of life. Third, the predictor model to determine risk factors for PTSD in relation to medical trauma should be complemented by adding indicators of the proxies' prior mental health including history of trauma. Furthermore, because ongoing exposure to stressful events in the aftermath of a PTE are strong predictors of PTSD (Brewin et al., 2000; Ozer et al., 2003), and especially contributing to the maintenance of the disorder (Schnurr et al., 2004), the predictor model of the proxies' PTS should

account for these influences, too. Research on traumatic stress related to cancer points to the fact that such stressors might emerge due to the course and treatment characteristics of the illness (Kangas et al., 2002; Köllner, 2009). With regard to severe TBI the neurobehavioural changes of the patient in particular were linked to emotional deficits in the patients' significant others at long-term (Schönberger et al., 2010). In addition, and to draw further implications for clinical practice, the proxies' attitudes towards as well as their experiences with the medical system treating the patient's brain injuries should be considered. Such perceptions were relevant for the patients' adaptation to other types of critical illnesses (Auerbach et al., 2005; Tedstone & Tarrier, 2003), and seemed to be an important issue for the TBI patients' significant others, too, as some participants of the PEBITA study informally disclosed during the follow-up sessions. Finally, further psychological characteristics of the proxies' coping process should be evaluated, e.g., perceived social acknowledgement, and perceived support from others, to further analyse the unique contribution of dysfunctional disclosure tendencies primarily focussed in this PhD thesis.

Future disclosure studies

Taking account of the complex interplay between trauma-related social interactions and PTSD demands for sophisticated research designs guided by profound theory (Guay et al., 2006; Maercker & Horn, 2011; Manne & Badr, 2008). To further illuminate the role of trauma disclosure, I suggest applying a *multiconstruct multimethod* approach that additionally implements *multiple perspectives* by simultaneously investigating both the individual affected by traumatic stress and his or her social environment. This approach is similar to the future directions proposed by Manne and Badr (2008) with regard to the research on interpersonal processes in couples' psychosocial adjustment to cancer. The authors suggested to reflect a dyadic perspective throughout the whole process of research, i.e., "when conceptualising the research question, choosing a study design, selecting methodology and measures, and by using dyadic level statistical approaches to analyse and interpret the data" (Manne & Badr, 2008, p. 2550). Beyond that, I suggest applying a research design that allows switching between the different perspectives on different levels of social proximity as proposed by the model of Maercker and Horn (2011).

With regard to disclosure of trauma, a *multiconstruct* approach means to further differentiate the intra- and interpersonal processes involved, and to achieve

more specificity in defining each of these facets. Possible disclosure conceptualisations are, for example, the willingness to disclose, attitudes towards disclosure, expected reactions upon disclosure, experienced difficulties and affective components of disclosing, perceived constraints upon disclosure by others, and the objective disclosure behaviour and its cognitive, emotional, physical and social consequences[10]. Thereby, processes which include negative social interactions should be given more weight because they seem to be more relevant with regard to PTSD (see section 1.2, p. 2). To indentify previously neglected aspects of trauma disclosure qualitative research methods can lead the way to exploring the field and deriving new insights on interpersonal processes that should be studied quantitatively afterwards (Guay et al., 2006).

Employing a *multimethod* approach in this context furthermore means that, in addition to self-report measures, studies should include observational data on the basis of direct assessments of behaviour (Guay et al., 2006; Hagedoorn, Sanderman, Bolks, Tuinstra, & Coyne, 2008; Manne & Badr, 2008). With regard to trauma disclosure, interaction episodes with dyads talking about a traumatic experience could be video-taped and coded according to the above listed objective disclosure facets. One example is the study by Manne et al. (2004) who analysed video-taped interaction scenes of couples discussing a cancer-related topic, and coded self-disclosures and responsiveness of the spouses. However, provoking authentic "real-life" communication within the laboratory can be difficult and problematic. Diary methods, i.e., repeated self-report assessment of ongoing experiences, are probably less reactive on the natural interaction processes but effective in assessing momentary behaviours and cognitions (Bolger et al., 2003, for an overview). Accordingly, diary methods have been applied to study the interrelationship of self-disclosure, perceived partner disclosure, and intimacy (Laurenceau et al., 2005), and to examine the contribution of support provision and support reception to maintaining intimacy in couples dealing with cancer (Belcher et al., 2011). Most advantages are provided when diary reports are assessed electronically, e.g., via internet or handheld device (Bolger et al., 2003), which has recently been facilitated in access with the spread of smart phones (Raento, Oulasvirta, & Eagle, 2009). Data can either be assessed with a time-based or an event-based design. Event sampling of observational data means that a defined behaviour is detected whenever it occurs,

[10] Note that many of these aspects have been investigated by other authors before (see section 1.2.3, p. 9, and section 1.3.4, p. 20). Here, the emphasis is on combining these perspectives.

whereas interval sampling refers to observing and recording behaviour during a defined time period with a fixed or random assessment schedule (Bortz & Döring, 2006). To study the relationship between trauma disclosure and psychological adjustment it seems to be promising to combine both approaches in that, e.g., the participants initiate recording whenever they engage in conversations on trauma-related topics. Immediately afterwards they complete self-reports on aspects of the disclosure interaction episode as well as their actual mood. Across the following days there could be an interval of repeated assessments of PTSD symptoms. A substantial advantage of this method is that diary assessments automatically generate multiple longitudinal data of the concepts of interest. This approach—especially with a cross-lagged panel design—can be beneficial in illuminating the hypothesised mechanism underlying the relationship between trauma disclosure and pathology (see section 3.1.3, p. 37).

To empirically test theoretically derived causal hypothesis on the underlying mechanisms of related variables, the method of choice is an experimental approach in which the outcomes of differentially manipulated conditions are compared to approximate causal relationships (Bortz & Döring, 2006). Because of ethical considerations experiments in trauma research usually follow analogue designs in which non-clinical samples are exposed to a severe stressor, e.g., by watching a highly distressing movie (Weidmann, Conradi, Gröger, Fehm, & Fydrich, 2009, for an overview). The trauma film paradigm has been used to experimentally investigate trauma-related interpersonal processes (Lepore et al., 2004; Pruitt & Zoellner, 2008). For example, after watching a scene of a woman being gang raped, Lepore et al. (2004) manipulated different disclosure conditions in which the participants were either instructed, not to talk about what they saw, to talk about their experience without audience, to talk with a stranger who had not seen the movie and who validated the participant's disclosure, or to talk with a confederate who was instructed to challenge the participant's report. This approach could be developed further by adding another social interaction condition including a significant other of the participant exposed to the acute stressor. Hence, naturally occurring social interaction patterns could be studied. Furthermore, this research design would allow adding other interpersonal aspects such as indicators of relationship functioning and satisfaction. Therefore, it would facilitate multiple perspectives on the disclosure process focussing intrapersonal processes at the level of the individual, interpersonal

processes at the level of the dyad, and the covariations between these levels. The various variables could be assessed immediately after exposure, e.g., by videotaping and coding interaction behaviour. Furthermore, data could be collected with self-reports on the psychological response to the stressor (e.g., intrusions, avoidance, emotional distress), and on interpersonal processes (e.g. frequency of social sharing, dysfunctional disclosure tendencies, perceived social reactions or constraints upon disclosure). Ideally this approach could be combined with the diary assessment methods described above.

Applying the research methods described in the previous paragraphs produces data with some specialities that need to be addressed by appropriate statistical methods. First, when examining interpersonal processes, it was recommended to focus on social groups rather than on the individual. As a consequence, these data are non-independent (Cook & Kenny, 2004; Kenny, Kashy, & Cook, 2006). This means that, for example, within a couple dyad, the two spouses are likely to share certain characteristics because of their common experience that makes them more similar to each other than to other people. Statistical methods need to account for these within-couple dependences. Second, to gain more insight in the underlying mechanisms it is necessary to collect longitudinal data. Ideally, the variables of interest are assessed at multiple occasions, for example, with a diary method. A cross-lagged panel design allows—because of the time shift between parallel assessments of different constructs—to compare opposing path directions of the impact of one variable (e.g., disclosure tendencies) on the other (e.g., symptoms of PTSD; Bortz & Döring, 2006). Again, these data are non-independent because they represent within-person dependency. Statistical methods that account for both within-group and within-person dependency are *multilevel models* (Singer & Willett, 2003), also termed *hierarchical linear models* (Raudenbush & Bryk, 2002). Furthermore, special types of models have been suggested to treat dyadic data (Kenny et al., 2006), e.g. the *actor–partner interdependence model* (Cook & Kenny, 2005), which allows decomposing the effects on the level of the individuals from those at the dyadic level, and to test hypotheses on the interplay between those levels.

Finally, to fit all pieces of the puzzle together the proposed *multiconstruct multimethod* and *multiperspective* approach to study disclosure of trauma needs to be extended to include a number of variables that potentially moderate the relationship between trauma disclosure and PTSD, for example, gender or the cultural

background of the individuals involved. Anthropological research indicates that the significance of trauma disclosure varies among different cultures, with Western societies encouraging individuals to talk about their thoughts and feelings while in other cultures, especially in Asia, disclosure of emotionally relevant experiences can be less socially desired (Wellenkamp, 1995). Contrarily, with regard to the association between problematic disclosure tendencies and PTSD, Mueller et al. (2009) found similar effects among two samples of crime victims from Germany and China. Whereas cultural values differed between the two samples the correlation of dysfunctional disclosure style and more severe PTSD pointed to a universal phenomenon independent from cultural aspects. However, more research is needed to better understand the societal and cultural influences on interpersonal processes in relation to traumatic stress. This would include the third level of the socio-interpersonal model of PTSD (Maercker & Horn, 2011).

3.4 Final Conclusions

Evaluating the current knowledge on interpersonal aspects of trauma and PTSD, some general conclusions were drawn when providing the theoretical background of this PhD study. Thereby, trauma related interpersonal processes were found to be multifaceted involving reciprocal influences among the trauma survivor and the social context that exert both positive and negative effects on the involved individuals' mental health as well as on their interpersonal relationships. This observation lead to two basic claims: (1) the need for comprehensive theories capturing the intra- and interpersonal aspects of trauma adjustment, and explaining the linking mechanisms between these components, and (2) to study interpersonal processes in depth that are more trauma-specific compared to the broad concept of social support, for example, aspects of the disclosure of trauma.

The PhD sub-studies' findings demonstrated that severe traumatic brain injuries—as potentially traumatic events—exert an impact beyond the patient's physical health. Problematic patterns of trauma disclosure among the affected individuals were found to potentially exacerbate psychological stress reactions. In addition, a uniquely interpersonal association was observed with regard to the disclosure of trauma tendencies of dyads comprising an individual who sustained severe TBI and a significant other. Several possible explanations for the current findings were discussed drawing from the three interpersonal models of PTSD that meet the first requirement and point the way for the second. Additionally, theories on

interpersonal processes in relation to severe illnesses were included into the discussions, which are more specific in defining the underlying mechanisms of the links between social relationships and mental health. To further illuminate these pathways, several ideas for future research were presented promoting a *multiconstruct multimethod* and *multiperspective* approach on the concept of trauma disclosure. In sum, this PhD thesis adds one piece to the complex puzzle of interpersonal processes related to potentially traumatic events. Future research and clinical practice is best advised to combine intra- and interpersonal perspectives.

4 PUBLICATIONS

4.1 Posttraumatic Stress Symptoms in Relatives in the First Weeks after Severe Traumatic Brain Injury (Sub-study I)

4.1.1 Introduction

In developed countries, between 9 and 17 patients per 100 000 population suffer severe traumatic brain injury (STBI) every year (Bouillon et al., 1999; Masson et al., 2001). TBI therefore poses a major challenge to society (Jennett, 1996). Despite spending considerable resources on acute medical care and rehabilitation, many patients die soon after injury and many survivors suffer permanent disability. In a recent cohort study, 53% of patients admitted to hospital with STBI died within six months, 17% had unfavourable outcomes and only 29% favourable outcomes after six months (von Elm et al., 2008). STBI is not only a burden for society and patients, but also for relatives. Chronic conditions after TBI may impair family functioning and can cause mental health problems in familial caregivers (Verhaeghe et al., 2005). At least one third of these caregivers suffer from significant symptoms of depression and anxiety (Kreutzer et al., 1994b; Marsh, Kersel, Havill, & Sleigh, 1998). Studies have generally focused on long-term outcomes in relatives (referred to as *proxies* in the following), and little research has been conducted into immediate stress reactions shortly after the accident. This is surprising because less advanced coping skills and pre-trauma mental health problems have been amongst the predictors identified for poor adjustment and an increased proxy's burden following TBI (Verhaeghe et al., 2005). As far as we are aware, no studies on short-term posttraumatic stress (PTS) in proxies for STBI patients have been published. We therefore decided to assess risk factors associated with PTS syndrome in proxies of survivors of STBI and the short-term frequency and severity of PTS symptoms in these proxies.

4.1.2 Methods

The ethics committees of the University Hospitals of Geneva, University Hospital Centre Lausanne and Hospital of Sion approved the study protocol entitled 'Patient-relevant endpoints after brain injury from traumatic accidents (PEBITA)'. Written informed consent was obtained from patients and proxies within 14 days after the accident. Here we present cross-sectional baseline data for the first month of this prospective observational study, collected between June 1, 2007, and May 31, 2008.

Study population

STBI was defined as an Abbreviated Injury Scale score of the head region (HAIS) of 4 or 5, diagnosed in hospital and resulting from blunt or penetrating trauma. Patients of any age fulfilling these criteria admitted to the participating hospitals with neurosurgical facilities were enrolled into the study. Case identification and data collection started within 24 hours of the trauma.

Data collection and assessments

All data were collected manually by research collaborators. After verification, data were entered into a specific, secure database at the University Hospitals of Geneva. Medical and trauma data on patients were obtained from a specific out-of-hospital emergency medical services (EMS) protocol, and in-hospital medical charts. Additional information such as gender and relationship between patient and proxy was documented when obtaining informed consent.

The severity of the TBI was assessed using Update 1998 of the AIS (AAAM, 2001), which classifies all types of injuries according to their degree of threat to life on an ordinal scale ranging from 0 (*no injury*) to 6 (*lethal*). The scale's Anatomical Localizer is used to assign injuries to six different body regions. The highest injury score for each region is called the AIS score for the specific area, e.g. HAIS for the head region. In this study, all patients had to have HAIS scores of 4 (*severe*) or 5 (*critical*) according to the inclusion criteria. The scores were based on cerebral CT scans taken in the 24 hours after the accident. The Injury Severity Score (ISS) was also calculated for all patients with multiple traumas. This takes account of the AIS scores for all body regions, and is calculated by summing up the squares of the three highest scores (Baker & O'Neill, 1976). The ISS ranges from 0 to 75.

General injury severity was also assessed using the National Advisory Committee for Aeronautics (NACA) score (Schlechtriemen, Burghofer, Lackner, & Altemeyer, 2005; Weiss, Bernoulli, & Zollinger, 2001). Originally developed in the United States for the triage of injured soldiers, this instrument is now widely used to describe illness and injury severity in pre-hospital emergency situations in Switzerland, Austria and Germany. The NACA score ranges from 0 (*no injury or illness*) to VII (*death*). Because of our inclusion criterion of HAIS > 3, our sample included only patients with an NACA score > III (IV = *heavy injury, life threat cannot be excluded;* V = *acute mortal danger;* VI = *breath and/or cycle stop and/or reanimation*).

The Glasgow Coma Scale (GCS) was used as a second measure of brain injury severity (Teasdale & Jennett, 1974; Teasdale et al., 1979). This scale rates patients' reactions to verbal and pain stimuli and thus indicates the level of consciousness. It is calculated by summing up the scores for best eye response (maximum score: 4), best verbal response (maximum score: 5), and best motor response (maximum score: 6), with a final score between 3 (*deep coma or death*) and 15 (*fully awake person*). The GCS was assessed at three time points: (1) on arrival of the emergency services at the accident scene, (2) when the patient was admitted to hospital, and (3) 14 days after the trauma.

The Impact of Event Scale–Revised (IES–R) was used to assess the severity of PTS symptoms in proxies (Weiss & Marmar, 1996). With three subscales, the IES–R covers intrusions, avoidance behaviour, and hyperarousal symptoms related to the three symptom clusters of posttraumatic stress disorder (PTSD). Respondents are asked to indicate on a five-step scale (0 = *not at all* to 4 = *extremely*)[11] how much they were distressed by each of the total of 22 symptoms during the past seven days. We instructed proxies to base these assessments on the accident of their relative as a potentially traumatizing event. Ideally, proxies were to complete the questionnaire 14 days after the accident. For practical and organisational reasons, the actual times of completion ranged from 5 to 23 days (*Me* = 11) afterwards.

Experts in trauma research recommend the IES–R as a good measure of PTSD (Brewin, 2005), although it does not exactly correspond to the 17 PTSD symptoms defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR, APA, 2000). The French version of the IES–R used in this study showed satisfactory internal consistency (Cronbach's alpha coefficients ranging from .81 to .93 for the three subscales and total score) and test-retest reliability (interval of three months, correlation coefficients ranging from .71 to .76), and replicated the theoretically derived factor structure (Brunet et al., 2003). Although combination of the three subscores to form a composite measure of PTS is not recommended (Maercker & Schützwohl, 1998), research has shown that clinically relevant cases of PTS can be identified by applying a cut-off point to the total sum score. In this study, we used the cut-off of 33 suggested by Creamer et al. (2003), with a predictive power of .88 (sensitivity .91; specificity .82) in their community sample of Vietnam veterans.

[11] Note that other studies with the IES–R have used the scaling format of the original IES (e.g., 0, 1, 3, 5; Brewin, 2005)

Statistical analysis

Data are provided as mean and standard deviation (*SD*), range, number (n), or per cent (%). The influence of the following variables on proxies' IES–R scores was tested: proxies' gender, type of proxy, GCS, NACA score (dichotomized into *heavy/potentially life threatening* and *acute mortal danger/reanimation*; median split), HAIS scores, ISS scores, whether surgery was performed, whether the patient was still comatose, and whether the patient was still in ICU when proxy completed the IES–R. Where normal distribution could not be assumed, nonparametric tests were used to test for statistical significance. This was the case for the drop-out analysis where we compared proxies who completed the IES–R with cases where no completed IES–Rs by proxies were available, with respect to the injury severity of the two patient groups. The Wilcoxon signed-rank test was used, expressed as the test statistic z_{Wilcox}. The GCS scores and times since the accident were also not normally distributed, and we used Spearman's correlation for these variables, reporting Spearman's rho (r_S) as correlation coefficient. Because the symptom clusters of intrusion, avoidance behaviour, and hyperarousal symptoms belong to one syndrome, PTSD, the IES–R subscales must be regarded as interrelated (Maercker & Schützwohl, 1998). Multivariate analysis of variance was therefore conducted for all group comparisons to test for potentially influencing factors, expressed as Pillai's trace as test statistic, which is recommended due to its robustness to violations of assumptions (Olson, 1976). Where significant multivariate effects were found, univariate analyses of variance were applied post hoc. The significance level for all tests was $p = .05$.

4.1.3 Results

Eighty-five STBI survivors were included. No proxy could be identified in five cases, eight proxies refused to take part in the study, and three had to be excluded because the period between the trauma and completion of the IES–R exceeded one month. The final sample consisted of 69 proxies. The patient and proxy datasets were complete for this final sample. Drop-out analysis showed no significant differences between proxies taking part in the study and those who did not with respect to injury severity (ISS) of the corresponding patients ($z_{Wilcox} = 2892.0$, *ns*). Three-quarters of the proxies were women and were partner or parent of the patient (Table 1).

Table 1. *Characteristics of Proxies (N = 69)*

n (%)	Women	Men
Total	52 (77.6)	15 (22.4)
Type of proxy		
Partner	22 (31.9)	8 (11.6)
Parent	23 (33.3)	2 (2.9)
Child	7 (10.1)	5 (7.2)
Other*	2 (2.9)	

Note. *Gender not specified.

About 38 of the 69 patients had an AIS score of 5 indicating critical injury. Furthermore, 81% of the patients required admission to the intensive care unit (ICU) (Table 2). When the accident happened, 22 STBI survivors (31.9%) were sharing their household with their partners and children; another 17 (24.6%) were children or young adults living with their parents, and 14 (20.3%) shared their household with their partners, but did not have children. About 11 patients (15.9%) were single without children, and two (2.9%) had no firm relationship, but had children. Three STBI survivors (4.3%) were widowed, two of whom had children. At the time the proxies completed the questionnaire, 60 (87.8%) patients were on normal wards, nine (13.2%) were still in ICU, and eight (12.1%) of these were still comatose.

Correlation analysis did not detect a significant association between the time since the accident and the IES–R score, and the data were therefore considered homogeneous (intrusions: r_S = .03; avoidance: r_S = .05; hyperarousal: r_S = .08; overall, $p > .05$). Mean IES–R sum scores were 13.38 (*SD* = 7.26) for intrusions, 8.91 (*SD* = 5.94) for avoidance behaviour, and 9.07 (*SD* = 6.75) for hyperarousal symptoms. About 36 (52.2%) proxies had an IES–R total sum score of 33 or higher, indicating a clinically relevant level of PTS symptoms. Women reported significantly higher levels of symptom severity as shown by multivariate analysis, $F(3) = 3.11$, $p < .05$ (Table 3). Separately conducted univariate analyses of variance showed significant gender differences for the IES–R subscales intrusions, $F(1) = 7.50$, $p < .01$, and avoidance $F(1) = 6.65$, $p < .05$, but not for hyperarousal, $F(1) = 3.42$, *ns*. No group differences were found for type of proxy (spouse versus other relationship), $F(3) = 0.42$, *ns*.

Table 2. *Demographic and Trauma Characteristics, and In-hospital Outcomes of Patients (N = 69)*

Characteristics:	
Age (*M*; *SD*; *range*)	41.87; 21.68 (0–84)
Men (n, %)	47 (68.1)
Trauma mechanism (n, %)	
Road traffic accident	29 (42.0)
Fall	26 (37.7)
Sport accident	7 (10.1)
Other	7 (10.1)
Intention (n, %)	
Self-accident	46 (66.7)
Unintentional	18 (26.1)
Violence	4 (5.8)
Self-harm	1 (1.4)
NACA score (n, %)	
IV	32 (47.8)
V	33 (49.3)
VI	2 (3.0)
HAIS (n, %)	
4	30 (44.1)
5	38 (55.9)
Associated injuries (n, %)	38 (55.1)
GCS (*M; SD*; *range*)	
On scene	9.75; 4.30 (3–15)
At admission	8.24; 5.13 (3–15)
At 14 days	13.76; 2.92 (3–15)
Surgical interventions (n, %)	46 (67.6)
Admission to ICU (n, %)	55 (80.9)
ICU stay in days (*M*; *SD*; *range*)	5.55; 6.0 (0–27)
Duration of coma in days (*M*; *SD*; *range*)	2.63; 5.16 (0–32)
Hospital stay in days (*M*; *SD*; *range*)	22.62; 49.23 (2–372)

Note. NACA = National Advisory Committee for Aeronautics score, HAIS = Abbreviated Injury Scale score of the head region, GCS = Glasgow Coma Scale, ICU = intensive care unit.

Table 3. *Mean IES–R Subscale Sum Scores of Proxies*

	All	Women	Men	Pillai's Trace	
	n = 69	n = 52	n = 15		
IES–R scales	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*	*p*
Intrusions	13.38 (7.26)	14.83 (7.03)	9.33 (6.11)	3.11	.03
Avoidance	8.91 (5.94)	10.08 (5.88)	5.80 (4.74)		
Hyperarousal	9.07 (6.75)	10.02 (6.86)	6.40 (5.96)		

Note. IES–R = Impact of Event Scale–Revised.

Initial GCS scores at the accident scene and on hospital admission were the only indicators of injury severity that were inversely related to the proxies' IES–R scores (Table 4). No significant associations were observed between GCS scores 14 days after trauma and the proxies' IES–R scores.

Table 4. *Correlations between Patients' GCS Scores and Proxies' IES–R Subscale Scores*

	Patients' GCS scores		
Proxies' IES–R scores[a]	on scene	at admission	at 14 days
Intrusions	-.38**	-.35**	-.23 *ns*
Avoidance	-.33**	-.36**	-.14 *ns*
Hyperarousal	-.39**	-.30*	-.19 *ns*

Note. [a]assessed at *Me* = 11 days post trauma, ** $p < .01$, * $p < .05$, *ns*: not significant at 5% level.

No associations were found for NACA ratings by emergency services staff, $F(3) = 2.63$, *ns*; HAIS scores, $F(3) = 0.44$, *ns;* surgery performed $F(3) = 0.12$, *ns;* and total injury severity, indicated by ISS (intrusions: $r_S = .14$, *ns*; avoidance: $r_S = .02$, *ns*; hyperarousal: $r_S = .07$, ns). There were also no significant group differences for patients still in coma $F(3) = 0.22$, *ns;* or in ICU $F(3) = 0.76$, *ns*, when proxies completed the IES–R.

4.1.4 Discussion

We found substantial levels of posttraumatic distress in proxies of patients with severe traumatic brain injury in the period up to one month after their relative's accident. More than half of our sample had IES–R scores that indicated clinically relevant levels of PTS symptoms (Creamer et al., 2003). Our results were similar to

the level of traumatic stress found by McAdam et al. (2010) in a sample of 74 family members of ICU patients at high risk of death. Using the same measurement as in our definition (IES–R cut-off according to Creamer et al., 2003), they identified significant levels of PTS symptoms three to five days after their family member's admission to ICU in 57% of relatives. Previous studies that assessed PTS symptoms in relatives of ICU patients using other assessment instruments or older versions of the IES–R reported similar results (Auerbach et al., 2005; Azoulay et al., 2005; Jones et al., 2004; Paparrigopoulos et al., 2006). These studies included patients with a range of different indications for ICU treatment. A small number of studies in family members of patients with distinct life-threatening somatic conditions such as spontaneous subarachnoid haemorrhage (Noble & Schenk, 2008), heart transplantation (Dew et al., 2004) and implantation of a ventricular assist device (Bunzel et al., 2007) also found elevated PTS levels.

Factors significantly associated with PTS symptoms in our study were female gender and the initial GCS score. Although Pillai's trace provides a robust measure for differences (Olson, 1976), this apparent gender effect should be interpreted with caution because more than two thirds of our participants were women. However, similar gender effects have also been found in samples of family members of ICU patients (McAdam & Puntillo, 2009) and are a common finding in PTSD research in general (Tolin & Foa, 2006). Epidemiological studies report prevalence rates amongst women to be two times higher than for men (Olff, Langeland, Draijer, & Gersons, 2007). Interestingly, the type of proxy was not relevant in our results. This finding contradicts previous exploratory research where spouses seem much more affected by their loved one's injury than children, siblings, or friends (Kreutzer et al., 1994b; Paparrigopoulos et al., 2006).

One major finding is that both the patient's GCS assessment on arrival of the EMS staff at the accident scene and the GCS on admission to hospital were significantly negatively associated with the proxy's early distress: the poorer the initial state of consciousness of patient, the higher the level of PTS symptoms in the proxy some days later. None of the other indicators of trauma intensity tested were significantly associated with the severity of the proxy's PTS symptoms, e.g. the AIS score for head injury. This finding is similar to the results of studies on ICU patients' relatives, where injury severity was consistently not associated with the degree of the distress (Anderson et al., 2008; Paparrigopoulos et al., 2006). The nature of the GCS

assessment may possibly explain why the initial GCS scores but no other indicators of severity of brain injury were associated with the proxy's level of PTS symptoms. In clinical practice, the GCS is used as a measure of brain injury severity but further than that, it may perfectly mirror what proxies experience with their relative suffering from head injury shortly after the accident: Patients often do not respond to verbal or tactile stimuli, and they show little or no eye or body movements. The initial GCS ratings may also affect how medical staff deals with the emergency situation, e.g. acting more hurriedly and leaving proxies uninformed and alone. This may engender a high degree of anxiety in proxies, reflecting the seriousness of the emergency situation rather than the actual severity of the patient's injury or subsequent condition. What makes this finding surprising is that our proxies' PTS reactions were not assessed immediately after the accident, but several days later.

Two implications can be drawn from this study. First, the short-term impact of STBI on proxies should be assessed as it may influence their ability to be involved in decisions on the patient's treatment or end-of-life decisions. The IES–R is a useful tool to assess distress in proxies and may help medical staff to carefully adapt their communication style to the affective state of decision makers. Second, initial mental health problems should be assessed and treated as they might complicate long-term adjustment. Research shows that the level of the caregiver's burden when taking care of a relative with impairments following TBI—and even the patient's recovery itself—partly depend on the coping abilities of the caregiver (Verhaeghe et al., 2005; Wells et al., 2005). A relative who suffers from intrusions or hyperarousal symptoms in the first few weeks after the accident might not be able to cope with actual and future stress.

We know from trauma research that PTS symptoms naturally decrease in the weeks after the trauma, and persist in only a small proportion of affected people (Kessler et al., 1995). With a prospective study design, Anderson et al. (2008) found that relatives of patients being treated in ICU showed a decrease in anxiety and depression symptoms over time, but still had high rates of PTSD and complicated grief even six months after admission. Contrarily, Auerbach et al. (2005) observed a marked decrease in acute stress symptoms in relatives between admission and discharge of ICU patients. Consequently, they concluded that the development of full-blown PTSD is unlikely in this population. It seems to be reasonable that other factors, such as length of stay in ICU, might have an influence on the course of the

proxy's PTS symptoms (Chui & Chan, 2007). Because we reported on cross-sectional findings here, no conclusions on possible future impairment can be drawn. Longitudinal studies are therefore needed to investigate the course of PTS symptoms in proxies of patients with STBI.

Beyond that, our study also has other limitations. To report the overall level of distress in our sample, we used the IES–R as a categorical measure to classify results by means of a cut-off score. This approach must be exercised with caution because the three symptom clusters of intrusions, avoidance, and hyperarousal contribute to different degrees to the syndrome of PTSD (Maercker & Schützwohl, 1998). Therefore, we conducted all other analyses for each IES–R subscale separately. Second, our results are generalizable only to proxies of patients with STBI because we included patients with a very limited range of injury severity. It is possible that less severe injuries might cause lower levels of symptom severity in relatives. Also, for practical reasons, the persons being interviewed were not chosen using defined inclusion criteria, but by the criterion of availability, and the quality of their relationship with the patient was not assessed. The study sample was therefore heterogeneous. However, no differences between types of proxy were found, which underlines the importance of including all relatives, and not only spouses. A further limitation was that little information was assessed on the proxies' psychosocial characteristics, and we were therefore unable to test the influence of established predictors of PTSD after trauma, such as age, level of education and economic status which may have also played an important role in our study (Brewin et al., 2000; Ozer et al., 2003). This is counterbalanced, however, by one of the strengths of our study: we collected much more information on patients enrolled than in other studies investigating illness-related distress in relatives (McAdam & Puntillo, 2009), and some of the factors involved proved to be significantly associated with the proxy's posttraumatic stress.

To conclude, family members and friends of patients with STBI are plunged into a traumatic situation and subsequently develop PTS-related symptoms to different degrees. The Impact of Event Scale is a useful tool to assess symptom severity in this population. Levels of stress are higher in women and in proxies of patients with more severe initial GCS scores. Proxies in these groups may need greater support than others to assist them with decision-making and facilitate adjustment to permanent disabilities. Further research into risk groups in the short

and long term, and the long term impact on patients of PTS syndrome in proxies is warranted.

4.2 Psychological Adaptation to Life-Threatening Injury in Dyads: the Role of Dysfunctional Disclosure of Trauma (Sub-study II)

4.2.1 Background

Because traumatic events are never completely detached from the social context, research focusing exclusively on the traumatized individual overly simplifies the complex aftermath of trauma. Not only does the social environment play a key role in the traumatized individual's recovery, as shown by the results of meta-analyses (Brewin et al., 2000; Ozer et al., 2003), but also does trauma and posttraumatic stress disorder (PTSD) seem to affect close others and interpersonal relationships (e.g., Kaniasty & Norris, 2008; Monson & Taft, 2005). Previous research on social processes after trauma has two shortcomings: First, most studies have simply focused on the broad concept of social support rather than specifying particular forms of trauma-related social activity; second, although claiming to investigate interpersonal processes, most studies have not gone beyond the intrapersonal approach.

Dysfunctional Disclosure Tendencies

One specific social interaction after trauma exposure is the way that trauma survivors talk about their thoughts and feelings concerning their experience with others, and how listeners, in turn, react to these disclosures. Decades of research on Pennebaker's paradigm of written disclosure (Pennebaker & Beall, 1986) revealed that experimentally manipulated disclosure of distressing events enhances wellbeing (Frattaroli, 2006). Exposure theory (e.g., Bootzin, 1997), cognitive-processing theory (Pennebaker, 1993), and the social integration model (Pennebaker & Graybeal, 2001) have attempted to explain the positive effects by suggesting that disclosure of trauma promotes habituation to trauma-related emotions, enhances structuring and integrating the trauma memory, supports correcting dysfunctional cognitions about oneself and the world, and fosters the mobilization of social support (for an overview see Frattaroli, 2006). With regard to naturally occurring disclosure of trauma, different facets have been investigated, e.g. the perceived reactions to disclosure (Belsher et al., 2011; Bolton et al., 2003; Jacques-Tiura et al., 2010; Taku, Tedeschi, Cann, & Calhoun, 2009; Ullman, 2003), the extent to which individuals disclose to their partners (Davidson & Moss, 2008; Tim Hoyt et al., 2010), the type of recipients people choose to disclose to (Leibowitz, Jeffreys, Copeland, & Noel, 2008), and attitudes towards self-disclosure (Stephens & Long, 1999). Thereby empirical

findings on the potentially beneficial effects were rather mixed. Whereas some studies found trauma survivors to profit from disclosure (Bolton et al., 2003; Bowen, Shelley, Helmes, & Landman, 2010), other authors emphasized that benefits depended on the listeners' supportive reactions (Taku et al., 2009), and that negative reactions to disclosure were associated with poorer adaptation (Jacques-Tiura et al., 2010; Taku et al., 2009; Ullman, 2003).

A series of studies have found certain modes of trauma-related communication to be associated with increased distress in several trauma groups (Mueller et al., 2008; Mueller et al., 2009). Specifically, trauma survivors who indicated that they did not want to reveal thoughts and feelings about the trauma to others, but also those who perceived a strong desire for talking about it again and again, as well as individuals who experienced intense emotional and physical reactions when they did so, were found to suffer from more severe symptoms of posttraumatic stress (PTS) than others who did not report such difficulties. Whereas perceived reluctance to disclose was consistently found to be independent from reported urge to talk about the trauma, substantial inter-correlations were found between experienced emotional and physical reactions during disclosure and the former two disclosure styles (Maercker et al., 2009; Müller et al., 2000; Mueller et al., 2008). The three modes of disclosure can be interpreted as a reflection of PTS reactions in communication: Avoidance of trauma-related stimuli may manifest itself in communication as a reluctance to talk about thoughts and feelings concerning the traumatic experience. Experiencing a strong desire to talk about the topic again and again may reflect intrusive reliving of the trauma and rumination of trauma-related thoughts. Furthermore, going all over the experience again may cause PTS reactions such as elevated arousal, and feelings of grief, shame, or guilt.

Because confrontation with trauma associated contents is highly effective in trauma therapy (e.g., IOM, 2008; McLean & Foa, 2011), and as avoidance behavior and rumination are known to sustain PTS symptoms (e.g., Ehlers & Clark, 2000; Ehring, Frank, & Ehlers, 2008; Zetsche, Ehring, & Ehlers, 2009), it can be assumed that the three modes of disclosure interfere with emotional and cognitive processing of the trauma. This may disrupt the natural process of recovery in which initial stress reactions decrease without intervention, and may consequently contribute to the maintenance of PTS symptoms. Primary evidence for this assumption was found in a prospective study with crime victims from Germany (Mueller et al., 2008). In this

study such disclosure styles prospectively predicted PTS above and beyond basic etiological factors of PTSD including initial PTS symptom severity. In the following, we will refer to the described modes of trauma disclosure as *dysfunctional disclosure tendencies*.

The Interpersonal Perspective

One crucial insufficiency of the cited studies is that aspects of trauma disclosure have only been assessed and related to psychopathology within the traumatized individual ignoring potential interactions with the social environment. Because communication involves at least two parties, it seems obvious to include the social context when studying trauma-related communication. From a more general perspective on coping with major life stressors such as cancer, Lepore (2001) proposed the concept of *social constraints* on disclosure, meaning "both objective social conditions and individuals' construal of those conditions that lead individuals to refrain from or modify their disclosure of stress- and trauma-related thoughts, feelings, or concerns" (Lepore & Revenson, 2007, p. 315). Whereas without social constraints, the natural desire to disclose emotionally relevant issues to others may enhance the cognitive processing of stressors, suppressing the desire to disclose may be associated with worse adjustment to the trauma (Lepore et al., 1996). In a sample of treatment seeking trauma survivors Belsher et al. (2011) found perceived social constraints to be positively related to PTS. This correlation was partially mediated by negative posttraumatic cognitions. The authors conclude that a social context which inhibits and invalidates trauma disclosure causes distress, and consolidates negative posttraumatic appraisals which, in turn, foster the maintenance of PTS symptoms. However, the study could lead to premature conclusions because social constraints were only assessed by self-reports of the trauma survivors. Cognitive change due to trauma and PTS may have biased the traumatized individuals' ratings, leading to multicollinearity between the observed concepts. To overcome this limitation, we attempt to adopt an interpersonal perspective by assessing the variables of interest in both parties of a dyad experiencing trauma. Furthermore, because we intend to study naturally occurring disclosure after trauma and do not want to interfere with personal habits of (non)disclosure, we assess self-reports on dysfunctional disclosure tendencies rather than applying an experimental design in which participants are instructed to talk about the trauma even though they would potentially not do in real life. When assessed in both partners at the same time, self-reports on dysfunctional

disclosure tendencies—comprising reluctance to disclose aspects of the trauma, and/or urge to talk about the trauma, and/or intense reactions during disclosure—can provide interesting indications of the trauma-related communication effectively going on within the dyad. For example, if both partners feel reluctant to disclose their thoughts and feelings about the trauma subsequently no such conversation is likely to happen. In line with Lepore's theory (2001) and findings on mutual influence within trauma-affected dyads (Monson, Gradus et al., 2009), we expect worse adaptation to trauma in dyads with both partners reporting dysfunctional disclosure styles.

Life-Threatening Injuries from Accidents

Severe traumatic injuries involving life-threatening medical conditions offer a useful context for studying dyadic interactions post trauma. For both the injured individual and the significant other, this may involve fear of death, disability, or loss. The traumatic event happens suddenly and unexpectedly and seems to be uncontrollable. Accordingly, both survivors and significant others have been found to experience increased distress in terms of PTS as a consequence of medical trauma (McAdam & Puntillo, 2009; Noble & Schenk, 2008; Pielmaier, et al., 2011; Zatzick et al., 2006).

4.2.2 Objectives

The first aim of this study was to replicate the findings of previous research showing that a dysfunctional disclosure style is related to higher PTS symptom severity within the individual in both patients with severe traumatic injury and their significant others. Second, we expected to find additional interpersonal associations among disclosure and psychopathology: In particular, we hypothesized that—at a dyadic level—a dysfunctional disclosure style of one individual would be associated with higher symptom levels of PTS in the other, over and above the intrapersonal effect of self-reported dysfunctional disclosure.

4.2.3 Methods

The data stem from the research network on Patient-relevant Endpoints after Brain Injury from Traumatic Accidents (PEBITA), which aims to evaluate the incidence and one-year health outcomes of severe traumatic brain injury (TBI) in Switzerland. In this article, we present cross-sectional data from a nested study of PEBITA on the psychological consequences of TBI on patients and their significant others conducted in the German speaking part of Switzerland only.

Participants

Patients were eligible for the study if they had experienced severe TBI defined as an Abbreviated Injury Scale score for the head region of 4 = *severe* or 5 = *critical* based on in-hospital diagnoses and had been admitted to one of the participating hospitals with neurosurgical facilities in the German speaking part of Switzerland. Further inclusion criteria were a minimum age of 16 years, place of residence in Switzerland, fluency in written and spoken German, absence of severe cognitive deficits that would impair verbal communication, and the availability of a significant other also willing to participate in the study. Patients' significant others (proxies) were eligible to participate if they were a parent, romantic partner, close friend, child, or other relative. Proxies were either the person to whom medical staff referred to in the first days after injury when the patients were not able to make decisions themselves, or the person indicated by the patient as being most closely related to them. Again, minimum age was 16 years, and fluency in German was required.

During the recruitment period from December, 2009, to April, 2010, a total of 284 patients were included in PEBITA's follow up study, and 190 of those were willing to additionally participate in the nested study on psychological consequences of TBI. Forty-nine patients were excluded because of severe cognitive impairment (n = 34), insufficient German (n = 2), or because they did not complete all questionnaires (n = 13). In another 31 cases no proxy data were available because of refusal (n = 22) or because the patient did not indicate any significant other (n = 9). The final sample comprises a total of 70 patient–proxy dyads. Demographic and trauma data are presented in Table 5.

Table 5. *Demographics, Characteristics of the Accident, and of the Patient's Health (N = 70)*

Characteristics	Patients	Proxies
Type of relationship, *n* (%)		
Partner		36 (51.4)
Parent		20 (28.6)
Close friend		6 (8.6)
Child		5 (7.1)
Sibling/cousin		3 (4.3)

Note. Continuation of Table 5 on next page.

Characteristics	Patients	Proxies
Education, *n* (%)		
Higher level	10 (14.3)	15 (21.4)
Lower level	34 (48.6)	55 (78.6)
Unknown	26 (37.1)	-
Proxy's presence at accident, *n* (%)		
Not present		62 (88.6)
Present but not injured		7 (10.0)
Present and injured		1 (1.4)
Trauma mechanism, *n* (%)		
Fall	26 (37.1)	
Motor vehicle accident	14 (20.0)	
Bike accident	11 (15.7)	
Pedestrian	6 (8.6)	
Sport accident	6 (8.6)	
Object	5 (7.1)	
Other	2 (2.8)	
Intention, *n* (%)		
Unintentional, one party involved	43 (62.3)	
Unintentional, two parties involved	23 (33.3)	
Violence	3 (4.3)	
Initial GCS, *Me (min – max*)	13 (3 – 15)	
13 – 15, *n* (%)	30 (42.9)	
9 – 12, *n* (%)	12 (17.1)	
3 – 8, *n* (%)	14 (20.0)	
Not assessed, *n* (%)	14 (20.0)	
Days in hospital, *Me (min – max*)	33 (1 – 125)	
Location at 3 months, *n* (%)		
At home	61 (88.4)	
Rehabilitation/nursing home	8 (11.6)	
GOSE at 3 months, *Me (min – max*)	7 (3 – 8)	

Note. GCS = Glasgow Coma Scale; GOSE = Glasgow Outcome Scale Extended.

Patients were between 16 and 82 years old (*M* = 45, *SD* = 21) and most of them were male (77%). Proxies' mean age was slightly higher (*M* = 50, *SD* = 16) and the majority was female (79%). In half of the cases, the proxy was the romantic partner of the patient (51%). Most participants had sustained severe TBI in a road traffic accident (44%) or fall (37%). At three months after injury 14% of patients still had severe and 23% had moderate disability. More than half of the sample (63%) had recovered well in terms of functionality as assessed by the Glasgow Outcome Scale Extended.

Procedure

Case identification and data collection began within the first day of the patient's accident. Informed consent, medical and trauma data as well as demographic information were obtained by PEBITA's local collaborators in the participating hospitals within the first 14 days. Three months after the accident (*Me* = 95 days, *range* = 66 – 133), we invited patients and proxies to take part in a research session. The sessions took place either at the patient's home or at the institution he or she was located in at that point (acute care hospital, rehabilitation centre, nursing home) and were conducted by three trained clinical psychologists. On the basis of a clinical interview assessing the neuropsychological status the interviewers decided on the exclusion of dyads in which the patient was affected by pronounced communication problems.

Measures

Injury severity and functional recovery. The 1998 update of the Abbreviated Injury Scale (AIS; AAAM, 2001) was used to assess TBI severity. The AIS classifies all types of injuries to six body regions on an ordinal scale according to their degree of threat to life from 0 = *no injury* to 6 = *lethal*. AIS ratings for the head region were based on cerebral CT scans taken within 24 hours after admission.

A second measure of brain injury severity was provided by the Glasgow Coma Scale (GCS, Teasdale & Jennett, 1974; Teasdale et al., 1979), which is a clinical assessment of the level of consciousness. Ratings reflect patients' reactions to verbal and pain stimuli with a final score between 3 = *deep coma or death* and 15 = *fully awake person*. In this study, the GCS was assessed by the emergency services upon arrival at the accident scene.

The Glasgow Outcome Scale Extended (GOSE, Wilson, Pettigrew, & Teasdale, 1998) was administered to assess the functional status of the patient three

months after injury. This scale compares pre- and post-injury functional abilities and impairments in various domains of life (e.g., work, leisure time activities, interpersonal relationships, independence). Functional status is represented on an eight-point ordinal scale: 1 = *dead*; 2 = *vegetative state*; 3/4 = *lower/upper severe disability*; 5/6 = *lower/upper moderate disability*; 7/8 = *lower/upper good recovery*. The QOLIBRI group (von Steinbüchel et al., 2010) translated and linguistically validated the scale into German. Psychometric data on the original version showed high inter-rater reliability, convergent validity with functional as well as neuropsychological outcome measures, and sensitivity to changes (Wilson et al., 1998).

Symptoms of posttraumatic stress. For several reasons, we used different approaches to assess PTS symptom severity in patients and in proxies. We decided to use a clinical assessment instrument in patients to better control for potential overlaps between symptoms of PTS and complaints due to brain injury (see the recommendations of Bryant, 2001). However, because many patients were still rapidly exhausted due to the effects of their brain injury, we tried to limit mental load on participating patients by choosing a comparatively short yet reliable screening tool to assess PTS: the Short Screening Scale for DSM-IV PTSD (SSS–PTSD, Breslau et al., 1999). The SSS–PTSD comprehends five avoidance and numbing symptoms (C2, C4, C5, C6, C7) and two hyperarousal symptoms (D1, D5). This selection of symptoms was identified as being the most predictive for PTSD diagnosis status in a large population based sample. Furthermore, the scale showed high sensitivity and specificity, and correctly classified 96% of participants in an independent sample (Bohnert & Breslau, 2011). We administered the SSS–PTSD in the form of an interview asking patients how frequently and severely they had experienced each symptom in the previous four weeks. Patients were instructed to focus on symptoms relating to their accident and its sequelae (e.g., emergency treatment). Patients' answers were rated on a 4-point scale (0 = *never/only once* to 3 = *five times a week/almost always*), a total mean score was calculated representing PTS symptom severity. Good internal consistency and preliminary evidence for construct validity have been reported for the German version of the scale (Siegrist & Maercker, 2010). In this study internal consistency of the total score proved to be acceptable (Cronbach's $\alpha = .73$).

The proxies' level of trauma-related stress was assessed by the Impact of Event Scale–Revised (IES–R, Weiss & Marmar, 1996) a widely used and recommended assessment tool in trauma research (Brewin, 2005). Respondents were asked to indicate how distressed they felt by each of the 22 PTS symptoms over the past seven days on a 5-point scale (0 = *not at all* to 4 = *extremely*). Like the patients, we instructed the proxies to relate their assessments to the patient's accident and its sequelae. The German version of the IES–R used in this study has shown good psychometric properties (Maercker & Schützwohl, 1998). In our sample, internal consistency was high with Cronbach's α of the intrusions, avoidance, and hyperarousal subscales at .87, .87, and .89 respectively.

Dysfunctional disclosure tendencies. We used a short version of the Disclosure of Trauma Questionnaire (DTQ, Müller et al., 2000) to assess dysfunctional trauma disclosure style in patients and proxies. In the instruction we informed participants that we were interested in learning about how they have talked about the accident and its sequelae with the other person in the dyad in the period since injury. Participants were instructed to indicate their agreement with statements drafted by other people who had experienced similar conditions after an accident. Where possible, the wording of the original DTQ items was slightly changed to relate statements on disclosure tendencies to the partner in the observed dyad. An English translation of the version for dyads (DTQ–dyads) is provided as supplemental material of this article[12]. The scale has three subscales comprising (1) six items tapping reluctance to talk about the traumatic experience; (2) four items tapping urge to talk; and (3) four items tapping strong emotional and physical reactions while talking about the traumatic experience. Respondents indicated their agreement on a 6-point Likert scale (0 = *not at all* to 5 = *absolutely*). Mean scores were calculated for each subscale. Additionally, a total mean score was calculated across all items to represent the overall dysfunctionality of disclosure style. The original version of the DTQ showed satisfactory psychometric properties (Müller et al., 2000). With regard to the DTQ–dyads used in this study internal consistencies were acceptable with the exception of one subscale: In the sample of patients, Cronbach's α was .62, .79, .81, for the three subscales and .75 for the total score; in the subsample of proxies, the figures were .70, .75, .80, and .79, respectively.

[12] In this PhD thesis the questionnaire is presented in the appendix on page 139.

Statistical Analyses

Because most scales were not normally distributed, nonparametric correlation analyses were conducted reporting Spearman's correlation coefficients and medians as well as minimum to maximum ranges as descriptive data. The primary method of analysis was multiple hierarchical regression analyses predicting patients' and proxies' PTS symptom severity. The total mean score of symptom severity assessed with the SSS–PTSD served as dependent variable in the subsample of patients. Because the calculation of a total score is not recommended for the IES–R (Maercker & Schützwohl, 1998), we choose to conduct separate regression analyses for the three subscales in the sample of proxies. For each analysis, the same regression modelling strategy was applied: In a first step, we entered all basic predictors of PTSD selected for this study on the basis of meta-analytic findings (Brewin et al., 2000; Ozer et al., 2003). These were gender, age, and the functional status of the patient (GOSE) as an indicator of trauma severity. Because previous studies have found higher distress in TBI patient's spouses than in other significant others (Kreutzer et al., 1994b; Kreutzer et al., 2009; Paparrigopoulos et al., 2006), we also tested this association, having dichotomized the relationship categories into *intimate partner* versus *other relationship*. In step 2, we included the DTQ–dyads total scores of the proxy and the patient. In step 3, we tested the interaction between patient's and proxy's dysfunctional disclosure style following Aiken and West (1991) with predictor variables centred to the sample mean. To probe and plot significant interactions, we followed the suggestions of Hayes and Matthes (2009) and used the Johnson-Newman technique to identify regions of significance in the range of the moderator variable. All statistical analyses were performed using the SPSS software package for Windows (SPSS version 19) applying the macro 'MODPROBE' by Hayes and Matthes (2009).

4.2.4 Results

Descriptive data and correlations are displayed in Table 6. For both the patients and the proxies, the median PTS symptom severity scores indicated fairly low levels of distress, and the ranges did not include the maximum scores. For the patients, none of the indicators of injury severity at the time of the accident were significantly related to PTS symptom severity at three months after injury (initial GCS: r_s = .18, *ns*; length of stay in hospital: r_s = .07; *ns*). However, ongoing functional problems

Table 6. *Descriptive Statistics (Median, Range) and Correlations (Spearman's r_s) among Study Variables for Patients and Proxies (N = 70)*

		Mdn (*min-max*)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Patients																			
1	Age	41 (16-82)	-																
2	Gender[a]		-.03	-															
3	SSS–PTSD	0.14 (0-1.86)	.04	.25*	-														
4	GOSE	7 (3-8)	-.16	-.03	-.27*	-													
5	DTQ Reluct	0.83 (0-3)	.14	.21*	.33**	-.07	-												
6	DTQ Urge	1.50 (0-5)	.06	-.29**	.23*	-.07	-.11	-											
7	DTQ React	0.38 (0-4.3)	-.09	.18	.57**	-.31**	.39**	.40**	-										
8	DTQ Total	0.89 (0.2-2.9)	.09	.01	.48**	-.22*	.60**	.63**	.79**	-									
Proxies																			
9	Age	52 (19-79)	.58**	-.12	.04	-.08	.06	.18	.01	.14	-								
10	Gender[a]		.06	-.38**	-.07	.06	-.27*	.17	-.21*	-.14	.08	-							
11	Relationship[b]		.58**	-.29**	-.12	-.11	-.10	.26*	-.15	.01	.28**	.26*	-						
12	IES–R Intr	6.5 (0-27)	.20*	-.33**	.08	-.22*	-.20*	.14	.07	-.02	.29**	.19	.28*	-					
13	IES–R Avoid	5.5 (0-29)	.31**	-.19	.12	-.13	-.03	.34**	.12	.21*	.26*	.07	.31**	.61**	-				
14	IES–R Hyper	6.0 (0-24)	.22*	-.29**	.10	-.36**	-.08	.21*	.14	.14	.27*	.10	.30**	.81**	.64**	-			
15	DTQ Reluct	0.83 (0-3.3)	.26*	-.07	.22*	-.08	.30**	.15	.20*	.33**	.31**	-.09	.13	.32**	.55**	.42**	-		
16	DTQ Urge	1.25 (0-4.3)	.11	-.36**	.02	-.17	-.04	.21*	-.05	.07	.24**	.17	.22*	.24*	.30**	.26*	.10	-	
17	DTQ React	0.75 (0-4.5)	.11	-.37**	.21*	-.31**	.04	.33**	.31**	.34**	.24*	.25*	.21*	.51**	.58**	.56**	.45**	.48**	-
18	DTQ Total	0.96 (0-2.6)	.25*	-.34**	.25*	-.25*	.14	.30**	.20*	.34**	.37**	.14	.27*	.47**	.64**	.56**	.71**	.66**	.83**

Note.SSS–PTSD = Short Screening Scale for PTSD, GOSE = Glasgow Outcome Scale Extended, DTQ = Disclosure of Trauma Questionnaire–Version for Dyads (subscales: reluctance to talk, urge to talk, emotional and physical reactions while disclosing, total score), IES–R = Impact of Event Scale–Revised (subscales: intrusions, avoidance, hyperarousal), [a]male = -1/female = 1, [b]other relationship = -1/intimate partner = 1; one-tailed tests with $^{*}p < .05$, $^{**}p < .01$.

Table 7. *Hierarchical Regression Analyses Predicting PTSD Symptom Severity in Patients and Proxies (N = 70): Results of Step 3*

	Patients' SSS–PTSD			Proxies' IES–R								
				Intrusions			Avoidance			Hyperarousal		
	B	*SE B*	β	*B*	*SE B*	β	*B*	*SE B*	β	*B*	*SE B*	β
Step 1	$R = .38$, $R^2 = .14^{*}$			$R = .41$, $R^2 = .17^{*}$			$R = .31$, $R^2 = .10$			$R = .50$, $R^2 = .25^{**}$		
GOSE	-0.03	0.03	-.11	-0.36	0.43	-.09	0.12	0.45	.03	-0.88	0.41	$-.22^{*}$
Age [a]	0.00	0.00	-.08	0.03	0.04	.09	0.04	-0.02	-.15	0.03	0.04	.06
Gender [a]	0.18	0.05	$.31^{**}$	0.61	0.84	.08	0.13	0.88	.02	0.40	0.80	.05
Proxy type	–	–	–	0.76	0.68	.12	0.78	0.72	.12	0.82	0.65	.13
Step 2	$R = .71$, $R^2 = .50^{**}$			$R = .59$, $R^2 = .35^{**}$			$R = .61$, $R^2 = .38^{**}$			$R = .67$, $R^2 = .45^{**}$		
$DTQ_{patient}$	0.34	0.07	$.45^{**}$	-1.23	1.07	-.12	1.54	1.12	.15	0.07	1.02	.01
DTQ_{proxy}	0.20	0.07	$.27^{**}$	4.58	1.10	$.49^{**}$	5.26	1.15	$.52^{**}$	4.93	1.05	$.50^{**}$
Step 3	$R = .75$, $R^2 = .56^{**}$											
$DTQ_{patient}$*DTQ_{proxy}	0.29	0.09	$.22^{**}$	_[b]	_[b]	_[b]	_[b]	_[b]	_[b]	_[b]	_[b]	_[b]

Note. [a]age and gender of the person concerned; [b]no value because step 3 non-significant; SSS–PTSD = PTSD symptom severity; GOSE = Glasgow Outcome Scale Extended (functional status of patient); proxy type = type of relationship between patient and proxy dichotomized (other vs. intimate partner); DTQ = DTQ–dyads total mean score; $DTQ_{patient}$* DTQ_{proxy} = patient's and proxy's interacting disclosure tendencies; IES–R = Impact of Event Scale–Revised; two-tailed tests with $^{*}p < .05$; $^{**}p < .01$.

assessed at three months post-injury were associated with higher PTS symptom severity (r_s = -.27, p < .05). The functional status of the patient was also negatively correlated with the proxy's intrusions and hyperarousal symptoms, whereas the patient's level of PTS symptom severity was independent of the proxy's IES–R scores. For both patients and proxies, all within-person correlations between dysfunctional disclosure style and PTS symptom severity were significant and most were moderate sized according to Cohen's effect size classification (Cohen, 1988). Substantial within-person correlations with proxy's symptom severity were also found for proxy's age (r_s = .26 to r_s = .29, all ps < .05), and being an intimate partner to the patient (r_s = .28 to r_s = .31, all ps < .05). Patient's symptom severity was only significantly associated with female gender (r_s = .25, p < .05).

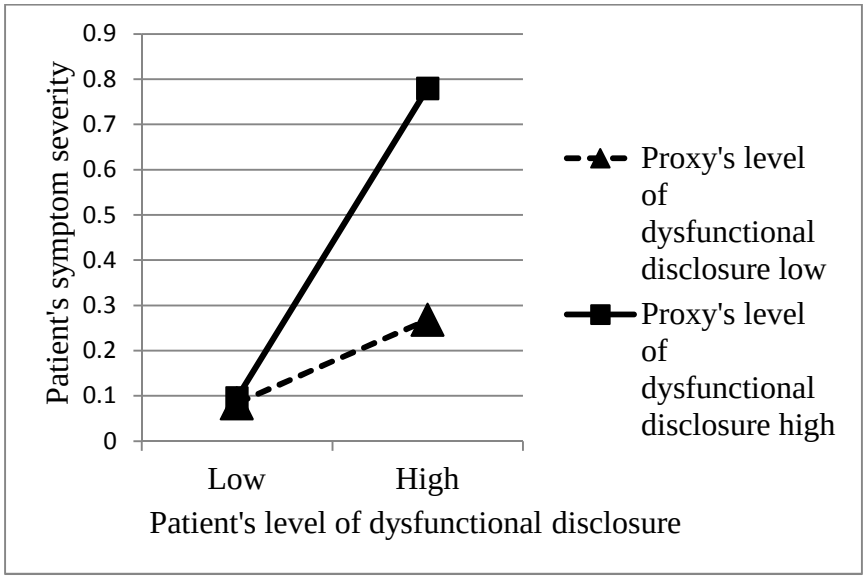

Figure 2. Illustration of the moderating effect of proxy's dysfunctional disclosure on the association between patient's level of dysfunctional disclosure and patient's PTSD symptom severity when covariates are set to their sample means.

Table 7 presents the results of regression analyses. In total, the predictors explained 56% of variance in the patient's and 35 – 45% of variance in the proxy's symptom severity. All regression analyses revealed self-reported dysfunctional disclosure tendencies to have incremental validity above and beyond the established predictors of PTSD (35% for patient's SSS–PTSD scores, 18% for proxy's intrusions, 28% for proxy's avoidance, and 21% for proxy's hyperarousal symptoms; all ps < .01). In addition, a significant interaction effect between patient's and proxy's DTQ–dyads scores was found predicting patient's PTS symptom severity (ΔR^2 = .07; b = 0.29,

95% CI [0.10, 0.48], *SE*[*b*] = 0.09; $t = 3.10$, $p < .01$). Step 3 was not significant for any of the proxy's symptom measures.

Figure 2 illustrates the conditional effects of patients' DTQ–dyads scores on their PTS symptom severity when proxies' DTQ–dyads scores were set to one standard deviation below and one standard deviation above the sample mean (*low level* vs. *high level*). The Johnson-Newman technique to identify regions of significance of the moderator revealed that the association between patients' DTQ–dyads and SSS–PTSD scores was statistically significant only if proxies had a DTQ–dyads total mean score of 0.53 or higher. This was the case for 81% of the sample. At the transition point of proxies' DTQ–dyads = 0.53, the conditional effect of patients' DTQ–dyads scores on PTS was $b = 0.19$ (*SE*[*b*] = 0.09; $t = 2.13$, $p < .05$; see Table 8 for more conditional effects). Because all conditional effects of patients' DTQ–dyads scores on PTS within the region of significance were positive, the interaction effect can be interpreted as follows: Patients who reported more dysfunctional disclosure experienced even more intense PTS symptoms if their significant other also had more dysfunctional disclosure tendencies.

Table 8. *Conditional Effects of Patients' Dysfunctional Disclosure scores on PTS Symptom Severity revealing the Region of Significance of the Moderator Variable (Proxies' Disclosure Scores)*

Proxy's DTQ–dyads total score	*B*	*SE B*	*t*	*p*
0.00[a]	.02	.13	0.19	.850
0.53	.19	.09	2.12	.039
1.06	.35	.07	4.88	.000
1.59	.51	.09	5.54	.000
2.11	.68	.13	5.01	.000
2.64[b]	.84	.18	5.54	.000

Note. DTQ–dyads = Disclosure of Trauma Questionnaire–Version for Dyads, [a]minimal score of the sample, [b]maximal score of the sample.

4.2.5 Discussion

In this study, previous findings on dysfunctional disclosure tendencies were replicated in dyads of an individual who had sustained severe traumatic brain injury (TBI) and a significant other (Maercker & Müller, 2004; Maercker et al., 2009;

Müller et al., 2000; Mueller et al., 2008; Mueller et al., 2009). Results revealed substantial within-person associations of PTS symptom severity with self-reported reluctance to talk about the accident and its consequences, with a strong desire to talk about it, and with intense physical and emotional reactions while disclosing after controlling for established predictors of PTSD. The reported moderate effect sizes are comparable with findings in a sample of crime victims (Müller & Maercker, 2006).

This study was the first to investigate self-reported dysfunctional disclosure at a dyadic level. A substantial interaction effect between patient's and proxy's disclosure style was found with regard to the patient's PTS symptom severity. Accordingly, the proxy's disclosure style modified the association between the patient's dysfunctional disclosure and PTS in terms of an enhancing interaction, with both predictors affecting the dependent variable in the same direction. This finding indicates that disclosure dysfunction in a significant other intensifies the association between the patient's own dysfunctional disclosure tendencies and mental health. Surprisingly, there was no effect of the patient's disclosure style on the proxy's PTS symptoms, either when tested as an independent predictor, or in terms of an interaction with the proxy's disclosure tendencies.

Although social constraints were not directly measured in this study, results can be interpreted against the background of Lepore's social-cognitive processing model (Lepore, 2001) suggesting inhibiting and invalidating reactions from interactants to impede cognitive processing of the trauma and thus lead to poorer trauma adjustment. In this study, proxies who themselves had dysfunctional disclosure tendencies may have constrained patients' attempts to disclose their concerns and feelings about the accident and its consequences. In consequence, these patients' processing and integration of the incident may have been impaired. It is possible that the effect of such social constraints on disclosure was more pronounced for the patient than for the proxy. Whereas the patients may have experienced a period of decreased social contacts due to physical impairment and therefore have been more dependent on his or her significant other, the latter was free to choose other interaction partners with whom to discuss their worries if the patient was not willing to talk about what happened. Therefore, the association between the proxy's disclosure style and the proxy's mental health may have been more independent of

the patient's disclosure style than vice versa. Because social constraints were measured indirectly, the proposed interpretation requires further empirical support.

The results are in line with the findings of the few studies that have investigated mutual influences after trauma by simultaneously measuring social interaction characteristics in both the trauma victim and a significant other (Monson, Gradus et al., 2009; Renshaw et al., 2008). Some studies drawing on dyadic data have identified certain cognitions (shared or unshared) to play a key role in both communication about the traumatic event and the adaptation process in general. For example, Monson, Gradus et al. (2009) found that in couples exposed to a severe flood, wives' world assumptions were associated with PTS symptom severity only if their husbands held less benevolent world assumptions. Thus, the cognitions of one partner moderated the association between negative trauma-related beliefs and pathology in the other. In a study by Renshaw et al. (2008), spouses of war veterans reported more symptoms of PTS if they perceived high levels of PTS in their husbands, but the veterans themselves reported low levels. One might hypothesize that this mismatch between veterans' self-reports of symptoms and spouse perceptions was caused by a lack of communication within the couple. These studies along with our finding demonstrate that social interaction processes after trauma exposure, such as the communication about trauma-related experiences, may interfere with individual recovery. Several authors have therefore emphasized the need to include mutual influences between the trauma survivor and his or her social environment in models of PTSD to fully understand its genesis and to use this knowledge to further develop treatment approaches (Maercker & Horn, 2011; Monson et al., 2010; Nelson Goff & Smith, 2005).

Limitations

First, one major limitation stems from the choice of trauma population. In this study, dyads comprising a patient with severe TBI and a significant other served as a case example for investigating naturally occurring trauma-related communication. Because TBI can affect communication abilities (Togher, 2011), it was necessary to exclude those patients with severe cognitive impairment. Subsequently the sample consisted of patients with better functional status three months after severe TBI. This may be one reason why PTS symptom levels in patients and proxies were fairly low. For the same reason, it is possible that the sample is not representative of individuals with poorer health outcomes after severe TBI, and results cannot be generalized

beyond patients with relatively good recovery. Furthermore, it has been well documented that TBI specifically impacts social life (e.g., Verhaeghe et al., 2005). Therefore, a potential interference between interpersonal problems specific to the consequences of TBI and PTS related communication problems cannot be ruled out. Although in the main analyses we controlled for the functional status of the patient including changes in social abilities, findings need to be replicated with a non-TBI trauma sample to be extrapolated beyond individuals with elevated PTS symptom severity after TBI. Second, the study's sample size is rather small. Data were collected within a large research network investigating the consequences of severe TBI in Switzerland. Lack of reimbursement for the additional time expenditure required in the nested study may be a reason why a large group of eligible patients refused to participate.

Another important limitation to the study concerns the applied methodology. Because of time constraints, we used a very short screening tool to assess symptom severity in patients. This measure may have led to underestimations of distress levels. Furthermore, the use of different measures to assess PTS symptoms in patients than in proxies, could be one reason why different regression models emerged for patients than for proxies. Therefore, the findings in the subsample of patients should not be directly compared to the results for proxies. However, one strength of the study is the application of a clinical assessment instrument to control for potential overlap between PTS symptoms and (neuro)psychological problems due to brain injury. Furthermore, despite the use of identical measurements for both partners of the dyad, future investigations on dyadic interactions in relation to PTS should capture more aspects of trauma-related communication such as perceived constraints and social reactions to disclosure.

4.2.6 Conclusions

To our knowledge this study was the first to examine the association between dysfunctional disclosure tendencies and PTS at a dyadic level. Disclosure tendencies of a significant other were found to intensify the within-person association between dysfunctional disclosure tendencies and PTS symptom severity of patients who sustained severe traumatic brain injury. To cast further light on the pathways between naturally occurring disclosure and PTS, future studies need to examine the course of disclosure styles and PTSD from a longitudinal and social-contextual perspective.

4.3 Trajectories of Posttraumatic Stress Symptoms in Significant Others of Patients with Severe Traumatic Brain Injury (Sub-study III)

4.3.1 Background

Severe traumatic brain injury (TBI) is a highly disruptive experience to the affected individuals and to their significant others. The suddenness of the event, the need for emergency treatment, a period of coma, and the absence of a clear prognosis leave the patients' relatives in states of uncertainty and concern. Furthermore, many patients who survive TBIs suffer from long-term disability and personality changes that can be highly challenging to the social environment. Accordingly, the significant others of patients suffering from severe TBI have been found to express severe psychological distress, mental disorders, and problems in family functioning (for an overview see Sander, 2007; Verhaeghe et al., 2005) for which several appropriate interventions have been developed and evaluated (Kreutzer et al., 2010; Norup et al., 2011). In contrast, a number of studies suggest that most significant others do not face such difficulties. In fact, researchers have reported positive outcomes for significant others, including satisfaction with their roles as caregivers (Machamer, Temkin, & Dikmen, 2002; Perlesz, Kinsella, & Crowe, 2000; Wells et al., 2005). In addition to the degree of injury-related neurobehavioral change in the patient (Anderson, Parmenter, & Mok, 2002; Anderson et al., 2009; Ergh, Rapport, Coleman, & Hanks, 2002; Livingston et al., 2010; Machamer et al., 2002; Minnes, Graffi, Nolte, Carlson, & Harrick, 2000; Ponsford & Schonberger, 2010; Schönberger et al., 2010; Taylor et al., 2001; Wells et al., 2005), demographic characteristics of the relatives (Gan, Campbell, Gemeinhardt, & McFadden, 2006; Kreutzer, Gervasio, & Camplair, 1994a; Perlesz et al., 2000), their maladaptive coping styles (Davis et al., 2009; Rivera, Elliott, Berry, Grant, & Oswald, 2007), and lack of perceived support from others (Ergh et al., 2002; Hanks, Rapport, & Vangel, 2007; Marsh et al., 1998) were repeatedly found to be associated with higher distress and burden among relatives. However, research on the wellbeing of significant others has been criticised for several methodological shortcomings, such as small sample sizes, selective sampling, and lack of longitudinal data (Schönberger et al., 2010). To date, most findings have been based on cross-sectional studies that assessed stress responses at highly varying times following injury.

Posttraumatic stress (PTS) reactions are symptoms of distress in response to a potential traumatic event (PTE), a highly aversive stressor, such as experiencing the life-threatening illness of a significant other. Typical symptoms of PTS are repeated distressing memories or thoughts of the trauma (intrusions), activities aiming to avoid PTE reminders, emotional numbing, hyperarousal, and hypervigilance (APA, 2000). PTS symptoms are also accompanied by impairments in the individual's functioning (Marshall et al., 2001; Westphal et al., 2011). To our knowledge, only two studies have investigated PTS in the significant others of patients with severe TBI, and both studies reported elevated levels of PTS symptoms in the first weeks after injury (Courtney, 1997; Pielmaier et al., 2011). Regarding other life-threatening medical conditions, significant PTS symptoms were expressed by relatives and/or friends of patients who survived spontaneous subarachnoid haemorrhages (Noble & Schenk, 2008), underwent heart transplantation (Bunzel et al., 2007; Dew et al., 2004), or suffered from a broad range of illnesses requiring treatment in intensive care units (ICU; Anderson et al., 2008; Auerbach et al., 2005; Azoulay et al., 2005; Chui & Chan, 2007; Jones et al., 2004; McAdam et al., 2010; Paparrigopoulos et al., 2006). Most of these studies either presented cross-sectional data or reported findings from repeated measurements conducted within small time intervals, e.g., from ICU admission to discharge (Auerbach et al., 2005; Paparrigopoulos et al., 2006). The only study with a longer perspective found a distinct decrease in anxiety and depression symptoms from one to six months after ICU treatment. However, this study reported that one third of the sample suffered from clinically significant symptoms of PTS at six months (Anderson et al., 2008). With respect to psychological distress in significant others of TBI patients, the only existing longitudinal study claims that elevated levels of depression and anxiety remain stable for up to five years after the accident (Ponsford & Schonberger, 2010). To the best of our knowledge, no study has yet investigated long-term PTS reactions in this population.

More generally, empirical findings on the psychological consequences of PTEs imply that not all affected individuals suffer from long-lasting disruptions in their level of functioning (Kessler et al., 1995; Peleg & Shalev, 2006). However, most studies have investigated the course of adaptation to PTE by studying mean changes in stress reactions across time, which may have concealed distinct patterns in the symptom course. On the basis of previous longitudinal findings Bonanno and

colleagues (Bonanno, 2004; Bonanno, Brewin, Kaniasty, & La Greca, 2010; Bonanno et al., 2011) proposed four prototypical trajectories representing inter-individual differences in coping with PTE or loss. Bonanno (2004) suggested that the majority of individuals would express a *resilient* pattern of coping defined by the absence of significant clinical distress at any point in time after the event. A comparatively smaller group of exposed individuals would express elevated stress reactions immediately after loss or PTE. Such distress would either decrease to a non-pathological level (*recovery* course) or persist over time (*chronic* course). A fourth possible pattern refers to significant distress arising after a period of normal functioning after loss or PTE, which is called *delayed onset* of disruptions (Bonanno, 2004). Employing a novel statistical approach, known as latent growth mixture modelling (LGMM, Curran & Hussong, 2003; Jung & Wickrama, 2008; Muthén, 2004), several studies have assembled sound empirical support for the existence of distinct adaptation trajectories in different trauma populations, such as military personnel (Bonanno et al., in press; Dickstein et al., 2010; Elliott, Biddle, Hawthorne, Forbes, & Creamer, 2005; Orcutt, Erickson, & Wolfe, 2004), victims of violence (Armour et al., 2011; Nugent et al., 2009), survivors of disasters (Holgersen, Klockner, Boe, Weisaeth, & Holen, 2011; Norris, Tracy, & Galea, 2009), and patients with severe illnesses (Bonanno et al., 2008; deRoon-Cassini et al., 2010; Lam et al., 2010). Whereas these studies differ in the number and shape of identified trajectory classes, one common finding is that the resilient group comprised the largest proportion of trauma survivors in most studies.

In the process of coping with severe or chronic disease, family members are often faced with the *dual role* of both struggling with illness-related stressors and the expectation of providing support to the patients (Revenson, 2003). It is therefore not surprising that impaired family functioning was related to less favourable rehabilitation success of patients recovering from TBI (Sander et al., 2002). This finding underscores the importance of carefully investigating the course of family members' stress reactions. In addition to gaining further knowledge on the nature of PTS trajectories as a response to severe TBI in significant others, applying a LGMM approach may be helpful in determining predictors of more or less favourable outcomes.

4.3.2 Objectives

Employing a latent growth mixture modelling approach, we expect to identify different longitudinal trajectories of PTS symptoms in individuals (proxies) with significant others who are suffering from the consequences of severe traumatic brain injuries three to twelve months after injury. In line with previous findings on symptom trajectories after loss and PTE, we expect to find one major group of resilient individuals who express fairly low levels of distress across all measurement points. At least one additional class is expected to emerge that is characterised by more pronounced PTS symptom severity. As a second aim of the study, we will test predictors of class assignment. We hypothesise that the significant others who are classified into the groups experiencing higher distress will be of the female gender, involved in a romantic relationship with the patient, and demonstrate worse functional outcomes in the patients. Furthermore, we expect significant others who report a dysfunctional style of trauma disclosure to be more likely to be assigned to a trajectory of more severe PTS symptoms. Dysfunctional style of disclosure is a specific indicator of trauma-related social interaction (Pielmaier & Maercker, 2011) that has been found to be associated with PTS after various forms of PTEs (Müller et al., 2000; Mueller et al., 2008; Müller et al., 2011).

4.3.3 Methods

Data presented in this report stem from a relative subsample derived from the research network on ‘Patient-relevant Endpoints after Brain Injury from Traumatic Accidents’ (PEBITA), a multicentre longitudinal study on the incidence and health outcomes of severe TBI in Switzerland. Individuals were eligible for the sub-study on psychological effects of severe TBI on significant others if they were a parent, spouse, romantic partner, close friend, child, or other close relative of a patient who had experienced severe brain injury and had been admitted to one of the eight hospitals with neurosurgical facilities in the German-speaking section of Switzerland. Severe TBI was identified using in-hospital diagnoses to score the severity of patients’ head injuries. The patients who scored greater than or equal to 4 = *severe* on the Abbreviated Injury Scale (AIS; AAAM, 2001) were classified as having severe TBI. Proxies were either the individuals acting on behalf of the patients in the first days after injury or the persons most closely related to the patients (as indicated by the patient). Furthermore, minimum requirements included an age of at least 15 years, place of residence in Switzerland, fluency in written and spoken

German, and survival of the patient. Cases were identified within 24 hours after the patient's accident. At three, six, and twelve months after injury, patients and proxies were invited to take part in a research session at the institution where the patients were located (e.g., acute care hospital, rehabilitation centre, nursing home) or at their homes. Some proxies preferred to conduct the interviews via phone and to return questionnaires via mail.

Participants

Between December, 2009, and April, 2010, a total of 284 patients were recruited for the PEBITA follow-up study, and 172 eligible proxies were willing to take part in the sub-study on the psychological effects of severe TBI on significant others. Of the eligible proxies, 135 completed the assessment at two or more measurement points and were included in the data analyses[13]. Proxies were mostly females (81%) between the ages of 15 and 82 (M = 51.8, SD = 15.5). About 73 proxies were intimate partners of the patients (54%), 33 (24%) were parents, 15 (11%) were children, 14 were siblings (5%), more distant relatives (2%), or close friends (4%) of the patients. The mean age of patients was somewhat lower than the mean age of the proxies (M = 49.7, SD = 21.8), and the majority of patients were male (78%). Most of the patients had sustained severe TBI in a traffic accident (42%) or after a fall (41%). The remaining 23 suffered a sports-related (8%) or other type of accident (9%).

Measures

The severity of the proxies' PTS symptoms was assessed using the Impact of Event Scale−Revised (IES–R, Weiss & Marmar, 1996), which is a recommended self-report measure of stress response to PTE used worldwide (Beck et al., 2008; Creamer et al., 2003). In this study, proxies indicated on a 5-point scale (0 = *not at all* to 4 = *extremely*) their level of distress for each of the 22 PTS symptoms in relation to the patient's injury and its sequelae (e.g., accident event, emergency treatment, ongoing disability) over the past seven days. The IES–R comprises three subscales that record stress symptoms similar to the three symptom clusters of the posttraumatic stress disorder according to the DSM-IV (APA, 2000): (1) intrusions, (2) avoidance behaviour, and (3) hyperarousal symptoms. There is an ongoing debate regarding whether the three symptom clusters should be combined to obtain an overall measure

[13] Note that cross-sectional data on a subsample of N = 70 patient-proxy-dyads from the same study have previously been published elsewhere (Pielmaier & Maercker, 2011).

of symptom severity (Creamer et al., 2003; Maercker & Schützwohl, 1998) and whether they change differently across time (King et al., 2009; Schell, Marshall, & Jaycox, 2004; Wu & Cheung, 2006). Therefore, we decided to conduct separate analyses for each of the three symptom clusters captured by the IES–R subscales. The German version of the IES–R that was used in this study has shown good psychometric properties (Maercker & Schützwohl, 1998). In our sample, internal consistency was high at all three measurement points (intrusions: .87, .88, .90; avoidance: .86, .81, .78; and hyperarousal: .87, .88, .86).

Self-reported dysfunctional disclosure of trauma style was assessed in proxies using a short version of the Disclosure of Trauma Questionnaire (DTQ, Müller et al., 2000) three months after the accident. The questionnaire is comprised of 14 statements on reluctance to discuss PTE-related thoughts and feelings, a strong desire to talk about such feelings, and experiencing intense emotional and physical reactions during disclosure. We informed proxies that we were interested in learning about the way in which they discuss the accident and its sequelae with the patient and other people, and we asked them to indicate their agreement with these statements on a 6-point Likert scale (0 = *not at all* to 5 = *absolutely*). Internal consistency of the DTQ total score was acceptable with Cronbach's α =.79.

To assess TBI severity in patients, the 1998 update of the Abbreviated Injury Scale (AIS; AAAM, 2001) was used. The AIS classifies injuries into six body regions on an ordinal scale according to their degree of threat to life from 0 = *no injury* to 6 = *lethal*. AIS ratings for the head region were based on cerebral CT scans taken within 24 hours after admission into a hospital.

The Glasgow Outcome Scale Extended (GOSE, Wilson et al., 1998) was used to assess the functional status of patients at three, six, and twelve months post injury. The scale compares functional abilities of various life domains, e.g., work, leisure time activities, interpersonal relationships, and independence from care with pre-accidental functioning. The current functional status of the patient is indicated on an eight-point ordinal scale. Because the survival of the patient was a criterion for the present study, there were no cases with a value of 1 = *dead*. To simplify further analyses, the trichotomous score of the original Glasgow Outcome Scale (GOS, Jennett et al., 1981) was used. This scale combines cases with values of 2 (i.e., *vegetative state*), 3, and 4 into a category of *severe disability*, values of 5 and 6 into a *moderate disability* category, and values of 7 and 8 into a category of *good recovery*.

Statistical Analyses

To identify discrete patterns of longitudinal change in proxies' PTS symptoms across time, we employed latent growth mixture model (LGMM) analyses (Curran & Hussong, 2003; Jung & Wickrama, 2008; Muthén, 2004). The LGMM is used to determine if a sample consists of multiple latent classes of subpopulations with differing outcome trajectories marked by within-class homogeneity of symptom course. An individual's assignment to a particular subgroup is modelled by a categorical latent variable and the specific growth curve within each class by continuous latent variables (e.g., intercept and slope). Furthermore, LGMM includes covariates in the growth models to test or control for their potential influence on the patterns of outcome trajectories and class assignments (Muthén, 2004). Evidence for divergent patterns of symptom courses exists when models with several classes show a better fit to the observed data compared to the one-class solution. However, the final model selection should not only base on the fit of competing models but also consider aspects of parsimony and theoretical assumptions about the course of symptoms. After retrieving the final model solution, an individual's most likely class membership can be identified by estimated posterior probabilities of class assignment.

In this study, LGMMs were calculated in Mplus version 5.2 (Muthén & Muthén, 1998-2000) using the robust full information maximum likelihood (FIML) estimator to handle missing date (Enders, 2001). FIML assumes missing values to be missing at random and are therefore independent from the outcome variable. Overall, 86 (64%) proxies completed all three assessments. Within the sample, 102 (76%) completed the first interview at three months, 129 (96%) at six months, and 125 (93%) at twelve months after the accident of their next of kin. Because previous research has repeatedly demonstrated that ongoing functional disabilities in the patients are positively associated with levels of distress in proxies, we included the dummy-coded, twelve-month GOS scores as covariates into LGMMs to predict class assignment. To identify the number of trajectory classes for each symptom cluster, a series of growth models were estimated with one to five class solutions for intrusions, avoidance, and hyperarousal symptoms. Best fit was determined by conventional fit indices, such as the Akaike information criterion (AIC, Akaike, 1987), the Bayesian information criterion (BIC, Schwarz, 1978), the sample size adjusted BIC (ssaBIC, Sclove, 1987), entropy values, and direct tests of model

comparison, such as the Lo–Mendell–Rubins likelihood ratio test (LRT, Lo, Mendell, & Rubin, 2001), and the bootstrap likelihood ratio test (BLRT, McLachlan & Peel, 2000). Generally, lower values of AIC, BIC, and ssaBIC indicate better fit, and higher entropy values indicate better classification. Furthermore, recent simulation studies suggest favouring the BLRT over the LRT to compare competing models (Nylund, Asparouhov, & Muthén, 2007). Because of the current disagreement on differential courses for the different symptom clusters mentioned above, we aimed to find a solution with equal numbers of classes for each symptom group. After obtaining model solutions for each symptom cluster, we compared class assignments of individuals across clusters. Applying logistic regression analysis, we examined the prediction of membership within a particular class by female gender, age, type of relationship, functional status of the patient (GOSE) at three months, and dysfunctional disclosure tendencies (DTQ) of the proxy at three months after the accident.

4.3.4 Results

Descriptive Data

Data on the proxies' and the patients' health outcomes at three, six, and twelve months after the accident are presented in Table 9. At first glance, proxies' mean IES–R scores reveal fairly low severity levels of PTS symptoms that change only slightly across the three measurement points. However, because we expected the sample to comprise different subgroups expressing divergent courses of distress and because of missing values, one should be cautious when interpreting these overall means. At three months after the accident, as shown by GOS scores, almost half of the patients recovered to their pre-injury level of functioning. Furthermore, Friedman's ANOVA indicated significant change in GOS scores across time, $\chi^2(2) = 20.71$, $p < .001$. This change can be interpreted as a steady improvement of a patient's functional status. Specifically, between three and twelve months after the accident, 29% of the patients ascended from one level of the GOS to the next, whereas 63% showed a stable functional status. Moreover, only a small number (8%) descended from one functional category to the proximate level below. Despite the overall improvement, a sizable number of patients (20%) still suffered from severe disability after twelve months. Such disabilities included needing assistance with daily activities, inability to work, or incapability to participate in leisure time activities, due to brain injury.

Table 9. *Characteristics of the Proxies' and Patients' Health at Three, Six, and Twelve Months Post-accident (N = 135)*

	3 months	6 months	12 months
Proxies' IES–R scores[a] (*M*, *SD*)			
Intrusions	1.24 (0.89)	1.20 (0.84)	1.16 (0.90)
Avoidance	0.85 (0.76)	0.86 (0.69)	0.73 (0.63)
Hyperarousal	1.12 (0.93)	1.00 (0.92)	0.83 (0.84)
Patients' location[b] (*n*, %)			
At home	91 (73%)	98 (80%)	111 (83%)
Rehab/nursing home	33 (27%)	25 (20%)	23 (17%)
Patients' GOS[c] scores (*Md*, *min–max*)	6.0 (2–8)	6.5 (2–8)	8.0 (2–8)
Severe disability (*n*, %)	43 (34%)	29 (24%)	27 (20%)
Moderate disability (*n*, %)	26 (21%)	32 (26%)	35 (26%)
Good recovery (*n*, %)	56 (45%)	61 (50%)	73 (54%)

Note. IES–R = Impact of Event Scale–Revised, GOS = Glasgow Outcome Scale, [a]not assessed in 33 proxies (24%) at 3 months, 6 (4%) at 6 months, and 10 (7%) at 12 months, [b]not assessed in 10 patients (7%) at 3 months, 12 (9%) at 6 months, and 1 (1%) at 12 months, [c]not assessed in 18 patients (13%) at 3 months, and 13 (10%) at 6 months.

Number of Trajectory Classes

Information criteria, entropy estimates, and *p*-values of model comparison tests for the one- to five-class solutions are presented in Table 10. The two-class-model was superior for both intrusions and hyperarousal symptoms compared to the simple model. Adding a third class did not relevantly improve fit indices or entropy values. Furthermore, when testing the two- versus the three-class model with BLRT, the best loglikelihood value was not replicated in a large number of cases. This finding indicates that although it is below the 5%-level of Type I error, the BLRT *p*-value is not trustworthy. The same situation occurred with the symptom cluster of avoidance in which the likelihood value comparing the single class versus the two-class model was not replicated in 14 out of 20 drawings. However, because we aimed to find comparable model solutions across symptom groups, we gave more weight to information criteria and to the entropy value with respect to avoidance symptoms. Entropy was nearly perfect in the two-class solution. Therefore, the final models comprise two trajectory classes for each symptom cluster. Although the patient's functional status at twelve months did not reveal a significant influence in the

models, it remained a covariate within the models to control for differences within the sample.

Table 10. *Fit Indices for One- to Five-Class Growth Mixture Models, Including Patient's GOS Scores at Twelve Months as a Covariate*

Symptom cluster	Growth Mixture Model				
	1 Class	2 Classes	3 Classes	4 Classes	5 Classes
Intrusions					
AIC	984.84	797.17	787.26	778.45	792.616
BIC	1002.27	840.75	854.08	865.61	900.111
ssaBIC	983.29	793.29	781.32	770.71	783.067
entropy		.91	.90	.84	.87
LMR *p*		< .01	.55	.51	< .001
BLMR *p*		< .001	0.08[a]	.00[a]	.03[a]
Avoidance					
AIC	785.62	619.25	595.59	580.95	570.80
BIC	803.06	665.74	662.41	668.11	672.48
ssaBIC	784.08	615.12	589.66	573.20	561.76
entropy		.97	.82	.86	.87
LMR *p*		.14	.02	.16	< .001
BLMR *p*		< .001[a]	< .001[a]	< .001[a]	.08[a]
Hyperarousal					
AIC	863.58	709.89	655.65	650.06	636.42
BIC	881.01	753.47	722.48	737.22	743.92
ssaBIC	862.03	706.02	649.72	642.32	626.88
entropy		.84	.75	.83	.85
LMR *p*		.36	.05	.38	.50
BLMR *p*		< .001	0.01[a]	0.09[a]	< .001[a]

Note. AIC = Akaike information criterion, BIC = Bayesian information criterion, ssaBIC = sample size adjusted BIC, LMR = Lo-Mendell-Rubin test, BLRT = bootstrap likelihood ratio test, [a]not replicated in most cases.

Symptom Trajectories

Table 11 displays estimates and significance levels for the intercepts and slopes of the two-class models. The corresponding trajectories are visualised in Figure 3, Figure 4, and Figure 5.

Table 11. *Growth Factor Parameter Estimates for Two-Class Models, Including Patients' GOS Scores at Twelve Months as a Covariate*

	Intrusions		Avoidance		Hyperarousal	
	Class 1	Class 2	Class 1	Class 2	Class 1	Class 2
	n = 117	n = 18	n = 124	n = 9	n = 95	n = 40
	Est	Est	Est	Est	Est	Est
	(*SE*)	(*SE*)	(*SE*)	(*SE*)	(*SE*)	(*SE*)
Intercept	1.11**	2.33**	0.77**	2.23**	0.81**	2.15**
	(0.08)	(0.25)	(0.06)	(0.37)	(0.18)	(0.22)
Slope 1:	0.04	-0.62**	-0.04	-0.03	-0.32**	0.02
T1 to T2	(0.09)	(0.19)	(0.06)	(0.44)	(0.10)	(0.23)
Slope 2:	-0.20*	0.44*	-0.04	-1.28**	-0.37*	-0.46
T1 to T3	(0.08)	(0.19)	(0.06)	(0.29)	(0.17)	(0.34)

Note. Est = Estimate, T1 = 3 months, T2 = 6 months, T3 = 12 months, $^{**}p < .01$; $^{*}p < .05$, indicates estimates significantly different from zero.

For each symptom cluster, LGMM revealed one major group of individuals with comparatively reduced levels of symptoms that were stable across the three measurement points. With respect to hyperarousal symptoms, this *lower level* class comprised 70% of the sample. Comparatively, 87% of individuals showed such a pattern for intrusions, and 92% for avoidance behaviours. When changes occurred in these lower level trajectories, there were more decreases indicated by a significant negative slope estimate. Although the second trajectory class is characterised by higher symptom severity at three months after the accident, the course of symptoms thereafter differs between the three symptom clusters. Approximately 13% of proxies showed a u-shaped course of intrusions, starting with a significant decrease from three to six months and followed by a significant increase above the initial level. With respect to avoidance behaviours, a small group of 8% showed a pattern of stable higher symptom severity between three and six months followed by a rapid decrease to the level of the low symptom class. Furthermore, approximately 30% of

the sample revealed a stable higher level of hyperarousal without significant change over time.

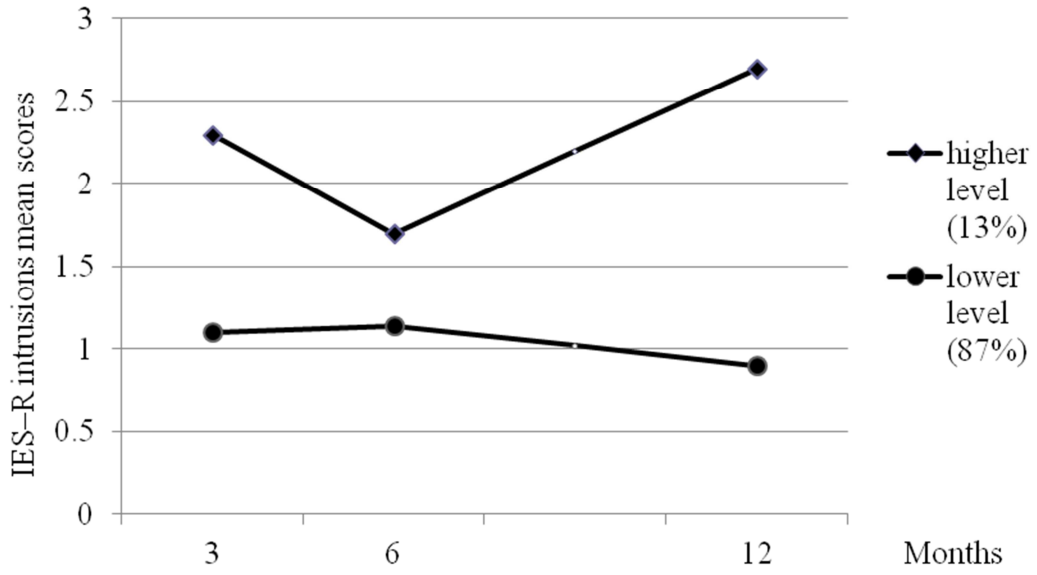

Figure 3. Two-class solution for intrusion symptoms, including patients' GOS scores at twelve months as a covariate.

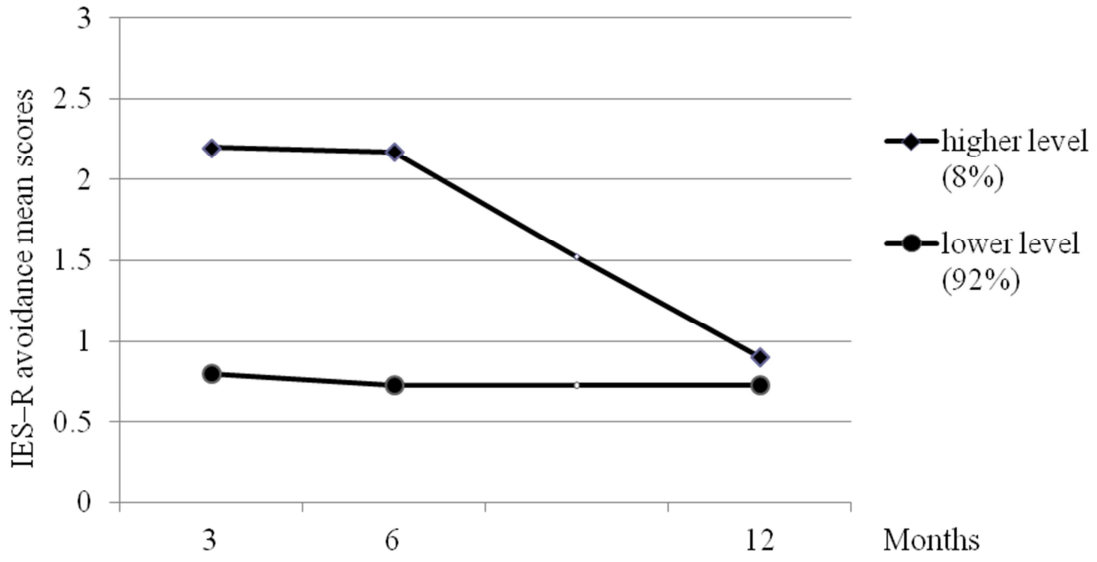

Figure 4. Two-class solution for avoidance symptoms, including patients' GOS scores at twelve months as a covariate.

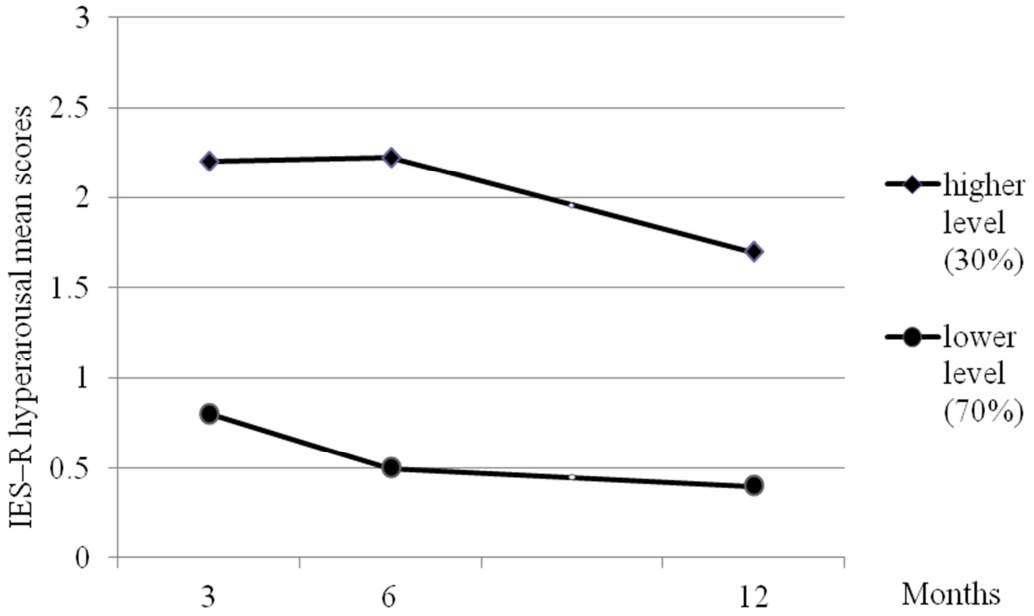

Figure 5. Two-class solution for hyperarousal symptoms, including patients' GOS scores at twelve months as a covariate.

Table 12 integrates the results for the three symptom clusters. A total of 85 proxies (63%) were in the lower level classes of PTE for each of the three symptom clusters. This finding indicates that these individuals were not distressed by PTS symptoms at any measurement point. The remaining 50 (37%) proxies expressed symptom trajectories with a higher level of PTS for at least one symptom cluster. This group of individuals will be termed the *higher distress* group in the following discussion, as opposed to the previously described resilient group.

Table 12. *Numbers of Class Assignments across Symptom Clusters*

				Hyperarousal	
				No	Yes
Avoidance	No	Intrusion	No	n = 85 (63%)[a]	n = 25 (18.5%)
			Yes	n = 7 (5.2%)	n = 8 (5.2%)
	Yes	Intrusion	No	n = 2 (1.5%)	n = 6 (4.4%)
			Yes	n = 0 (0%)	n = 2 (1.5%)

Note. [a] Resilient group.

Predictors of Membership to the Higher Distress Group

To identify predictors of an individual's assignment to either the higher distress group or the resilient group, a binary logistic regression analysis was conducted. Missing data on some of the predictor variables led to a somewhat smaller sample (n = 105) for this analysis. In this subsample, the proportion of individuals in the resilient group was slightly higher compared to the whole sample of the study, although this difference did not prove significant, $\chi^2(1) = 4.393$, $p = .05$. Furthermore, the samples did not differ with respect to gender $\chi^2(1) = 0.14$, $p = 1.00$; type of relationship with the patient $\chi^2(1) = 0.26$, $p = .68$; or age, Mann-Whitney $U = 1281.0$, $z = -1.56$, $p = .12$. Results of the regression analysis are presented in Table 13.

Table 13. *Prediction of Membership to the Higher Distress Group*

	Resilient	Higher Distress	Predicting Membership to the Higher Distress Group		
	Count (%) / *Md* *(min–max)*	Count (%) / *Md* *(min–max)*	*B* (*SE*)	OR	95% CI
Step 1.					
Female[a]	55 (78%)	30 (88%)	0.77 (0.71)	2.17	0.54 – 8.66
Partner[a]	36 (51%)	22 (65%)	-0.05 (0.52)	0.95	0.35 – 2.62
Age	48 (15 – 79)	56 (24 – 82)	0.01 (0.02)	1.01	0.98 – 1.05
GOSE 3	7 (2 – 8)	5 (2 – 8)	-0.14 (0.13)	0.87	0.68 – 1.11
Step 2.					
DTQ	0.64 (0.00 – 20.7)	1.54 (0.21 – 2.64)	1.68 (0.43)**	5.38	2.31 – 12.55

Note. Resilient Group: n = 71, Higher Distress Group: n = 34, [a]Reference category, GOSE 3 = Glasgow Outcome Scale Extended at 3 months, DTQ = Disclosure of Trauma Questionnaire total score, CI = confidence interval, *$p < .05$, **$p < .01$.
Step 1, $R^2 = .08$ (Hosmer & Lemeshow), .09 (Cox & Snell), .13 (Nagelkerke). Model $\chi^2(4) = 9.98$, $p < .05$.
Step 2, $R^2 = .22$ (Hosmer & Lemeshow), .24 (Cox & Snell), .33 (Nagelkerke). Model $\chi^2(5) = 28.55$, $p < .001$.

Although the proportion of female proxies, romantic partners, and proxy age were higher in the higher distress group, and the corresponding patients of these proxies

experienced greater disability at three months after the accident, these basic predictors of PTSD did not significantly contribute to the prediction of proxy group membership. A proxy's self-reported disclosure style was the only significant predictor among the potential predictors considered. Thereby, higher levels of dysfunctional disclosure style therefore significantly increased the odds of an individual's assignment to the higher distress group by five times. Thus, these individuals were more likely to be in the class of higher symptom severity for at least one PTS symptom cluster.

4.3.5 Discussion

Congruent with our hypothesis, this study revealed differential one-year longitudinal trajectories of PTS symptom severity in individuals with significant others who survived severe traumatic injuries. In line with previous research on adaptation to potential traumatic events or loss (Bonanno, 2004), the majority expressed no PTS symptoms or very low symptom levels three, six, and twelve months after the accident. Besides this resilient response group, latent growth mixture model analyses revealed a comparatively smaller proportion of individuals reporting more pronounced symptoms of PTS. This smaller proportion was indicated by three-month IES–R subscale scores that were comparably higher than they were in the subgroup of participants diagnosed with PTSD in a study of motor vehicle accident survivors (Beck et al., 2008). Although the longitudinal course of this second trajectory class slightly differed across the three PTS symptom clusters, it revealed a general pattern of persisting symptoms at an elevated severity level. These findings are in line with the only longitudinal study of psychological distress in the significant others of patients with TBI, which found a significant subgroup expressed chronic symptoms of depression and anxiety several years after an accident (Ponsford & Schonberger, 2010).

Employing the same methodological approach, three other studies have found two distinct symptom trajectories following PTE (Armour et al., 2011; Nugent et al., 2009; Orcutt et al., 2004). With similar assessment point intervals after trauma, Armour et al. (2011) found 35% of a sample of 255 rape victims showed a *low stable* PTS symptom trajectory. The remaining 65% of the sample expressed high symptom levels at three months after rape that decreased across time. Because sexual violence is known to be associated with a highest risk for PTSD (Kessler et al., 1995), it is not surprising that Armour et al. (2011) found that a large group of trauma survivors

suffered from more pronounced PTS symptoms. Some specific aspects of our study may explain why we did not find further trajectory classes as Bonanno (2004) had suggested. To demonstrate, a pattern of recovery was often found within the first weeks or months after PTE (deRoon-Cassini et al., 2010; Lam et al., 2010). As this study's first assessment was established at three months after the accident, a number of significant others might have already recovered from early distress by that time. Moreover, the fourth pattern of delayed PTS onset is less common among survivors of civilian PTEs (Andrews, Brewin, Philpott, & Stewart, 2007) and is a trajectory particularly experienced by military personnel seeking compensation (Armour et al., 2011; Frueh, Gold, & de Arellano, 1997). Finally, as previously indicated, the potentially traumatic experience of living with a significant other who sustained severe TBI may be ongoing rather than a single event, which may cause different trajectory patterns compared to other PTEs.

To date, there is insufficient knowledge on the differences in development or course of symptoms within each PTS symptom cluster. Therefore, although we conducted analyses separately, we did not propose specific hypotheses concerning this issue. The results of this study revealed slightly different pathways with a u-shaped course of intrusions, a significant decrease of avoidance behaviours between six and twelve months, and a stable course of hyperarousal symptoms across time. With regard to intrusion symptoms assessed with the IES–R, King et al. (2009) suggested that the construct might change over time, thereby leading to differing inter-correlations between the IES–R subscales at different measurement points. In our study, it is possible that re-experiencing symptoms was particularly common at the last assessment because it was the anniversary of the significant other's traumatic injury. Such anniversary reactions have also been reported among other trauma populations (Meisenhelder, 2002; Morgan, Hill, Fox, Kingham, & Southwick, 1999; van der Hart & Steele, 2008).

With regard to possible predictors of class assignment, this study found characteristics of the proxies, such as gender and relationship to the patient, to be less relevant. The only significant predictor of membership in the group with more pronounced PTS severity for at least one symptom cluster was the proxy's self-reported dysfunctional disclosure style. This characteristic tendency of feeling reluctant to share a traumatic experience with others, of perceiving a strong urge to talk about it, and of experiencing emotional and physical reactions during disclosure,

have been reported to be problematic in adaptation to a variety of PTEs (Maercker & Horn, 2011). In the broadest sense, dysfunctional disclosure tendencies can be interpreted as a proxy for perceived social support, which is a notably strong predictor of PTSD (Brewin et al., 2000; Ozer et al., 2003). Surprisingly, the patient's functional status at three months after the accident, which can be conceptualised as an indicator of trauma severity for proxies, was not significantly associated. However, studies indicate that other consequences of TBI, such as ongoing neurobehavioural problems, are more closely related to the significant other's stress response (Schönberger et al., 2010).

In addition to the abovementioned specifics of the design and population investigated, several methodological limitations of the study should be discussed. First, whereas the sample size is acceptable for conducting LGMM, the small size may have prevented us from identifying more than two trajectory classes. Second, although a sizable number of patients were recruited within the PEBITA study, the number of participants eligible for the current analyses was fairly low. Because the PEBITA's study protocol required a lot of time at each measurement point, many participants refused to participate or participated only once in the additional sub-study. Third, we focused only on symptoms of posttraumatic stress, while most other studies investigating the impact of TBI on family members and friends have studied distress more generally in terms of quality of life, depression, anxiety, and family functioning. Therefore, the results cannot be directly compared. Fourth, in this study, we investigated mainly female significant others, therefore, results might be biased to the typical female reactions to traumatic stress. However, results do at least account for females and may thus be generalized to the female population since we additionally ran all models with female participants only, these analyses revealed no differences to those we reported. Finally, it is recommended to establish four or more measurements across time to receive stable solutions for growth curves within trajectory classes. Therefore to generalise results, this study requires replication with a larger sample of data from significant others with a broader range of symptoms and indicators of psychological wellbeing assessed at multiple points in time after an accident.

Despite these important shortcomings, data presented in this report point to the need for monitoring stress responses in the significant others of TBI patients. This monitoring is relevant because these individuals play a key role in a patient's

recovery process. For example, in the first days after severe TBI, proxies may be responsible for decision-making, if the patient is not able to decide on his or her own treatment options. In the long run, it is also usually a close relative who, if necessary, takes on the role of primary caregiver. Psychopathology, such as PTS, is accompanied with problems in information processing and reduced overall functionality (Marshall et al., 2001; Westphal et al., 2011), which can impair the ability to adequately fulfil these tasks. Consequently, despite the negative impact on the lives of significant others, high levels of psychological distress, especially if they persist, can retroactively affect a patient's rehabilitation success (Sander et al., 2002). Early-stage identification of proxies' risk of experiencing a chronic course of distress can help to bundle resources and provide professional assistance to those in need. This study found evidence that elevated PTS symptom levels at three months post-injury and a problematic disclosure style can indicate long-term psychological distress. Future research should focus on identifying more predictors of a chronic symptom course in the patients' significant others.

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APPENDIX

Disclosure of Trauma Questionnaire–Dyads (DTQ–dyads)

Instruction to patients/proxies:

"Traumatic brain injury can be a severe burden for patients and their significant others. We are interested in a better understanding on how the affected individuals feel after such an accident. Therefore, we would like to ask you to indicate your agreement with some statements formulated by other people who had experienced a similar situation.

In the following we would like to know how it is for you to talk with _____ _____ (please indicate the name and date of birth of the significant other also participating in the study) and with other people about things that are related to the brain injury. These are experiences during the incident in which you/your significant other sustained brain injury as well as experiences concerning the consequences of the incident (such as being in hospital, surgery, pain, physical impairments ...). Please indicate how much you agree with the statements below. We are interested in your personal opinion."

		I agree…					
		not at all	hardly	some-what	fairly	much	Com-pletely
1.	I have talked about it with the person indicated above.						
2.	I have talked about it with other people.						
3.	The more often I talk about it, the clearer it becomes to me.						
4.	I feel like I need to talk about it a lot.						
5.	After I talk about it, I always feel exhausted.						
6.	I find it difficult to talk about it with the person indicated above.						
7.	I find it difficult to talk about it with other people.						

8.	I never find the right time to talk about what I experienced.						
9.	I feel extremely tense when I describe it.						
10.	I feel compelled to talk about my experiences again and again.						
11.	I like to talk about it as often as possible.						
12.	Describing my experiences makes me feel very sad.						
13.	When I describe the incident, my heart starts to pound, I start to sweat, or I start to shake.						
14.	I often think about my experience, but do not talk about it very much.						

Scoring key:

1. Score values from 0 (*not at all*) to 5 (*completely*).

2. Recode Items 1 and 2.

3. Subscales mean scores:

   A. *Reluctance to talk*: 1rec, 2rec, 6, 7, 8, and 14.

   B. *Urge to talk*: 3, 4, 10, and 11.

   C. *Emotional and physical reactions during disclosure*: 5, 9, 12, and 13.

4. Total score: mean score of all the 14 items.

ZUSAMMENFASSUNG

Die bisher überwiegend intrapersonell ausgerichteten Traumatheorien wurden in letzter Zeit erweitert, um der bedeutsamen Rolle von interpersonellen Prozessen im Zusammenhang mit Trauma und Posttraumatischer Belastungsstörung (PTBS) Rechnung zu tragen. Diese Dissertation fasst zunächst den aktuellen Wissensstand in Bezug auf soziale Aspekte von traumatischen Belastungen zusammen. Dabei wird vorgeschlagen, verschiedene Sichtweisen auf die sozialen Kontexte der Betroffenen einzunehmen, und dabei einzelne Komponenten des komplexen Zusammenspiels aus intra- und interpersonellen Aspekten der Traumaverarbeitung eingehend zu untersuchen. Lebensbedrohliche medizinische Ereignisse allgemein und schwere traumatische Hirnverletzung als ein Beispiel, können bei einem Teil der betroffenen Patienten und ihren Angehörigen zu Symptomen posttraumatischer Belastung führen. Diese Art potentiell traumatischer Ereignisse ist daher geeignet um traumabezogene interpersonelle Prozesse zu untersuchen.

Mit den drei Substudien dieser kumulativen Dissertation wurden zwei übergeordnete Ziele verfolgt: (1) die Auswirkungen schwerer traumatischer Hirnverletzungen auf nahe Angehörige der Patienten zu eruieren, und (2) die Rolle einer speziellen Form sozialer Interaktion nach Trauma zu untersuchen: das Offenlegen (*Disclosure*) traumabezogener Gedanken und Gefühle. In den Substudien I und III wurde die kurz- und langfristig auftretende posttraumatische Belastungssymptomatik der Angehörigen erfasst. Während etwa die Hälfte der Angehörigen in den ersten Wochen nach dem Unfall klinisch auffällige Ausprägungen posttraumatischer Belastungssymptomatik aufwiesen, zeigte nur eine kleine aber dennoch bedeutsame Untergruppe, langfristig erhöhte Symptombelastungen über den Verlauf eines Jahres. Mit den Substudien II und III wurde die Assoziation zwischen problematischen Disclosure-Tendenzen und der psychischen Anpassung an die Folgen schwerer traumatischer Hirnverletzungen bei Patienten und Angehörigen untersucht. Dabei wurden, im Einklang mit früheren Studien, substantielle intrapersonelle Zusammenhänge auf Seiten der Patienten und Angehörigen festgestellt. Darüber hinaus fanden wir in Substudie II einen zusätzlichen Effekt auf der Ebene der Patienten-Angehörigen-Dyade.

Die Ergebnisse werden vor dem Hintergrund aktueller interpersoneller Theorien der PTBS sowie chronischer Erkrankungen diskutiert. Anschliessend

werden Implikationen der Studienergebnisse für die klinische Praxis abgeleitet, einerseits in Bezug auf die Behandlung von Patienten und deren nahe Angehörige nach schwerer traumatischer Hirnverletzung, und andererseits bezüglich der Therapie der PTBS. Als eine Richtungsweisung für zukünftige Forschung zu interpersonellen Aspekten von Trauma und PTBS wird abschliessend am Beispiel des Disclosure-Konzepts ein Multi-Konstrukt-, multimethodaler und multiperspektivischer Ansatz vorgestellt.

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